

Cross cultural study of the effects of BI-culturation and Bilingualism
upon the cognitive development at the concrete operational stage in
Turkish children

A STUDY OF THE EFFECTS OF BILINGUALISM
AND BICULTURATION ON THE COGNITIVE DEVELOPMENT
~~OF TURKISH MIGRANT CHILDREN IN WEST GERMANY~~
AT THE CONCRETE OPERATIONAL STAGE IN
TURKISH CHILDREN

by

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A thesis submitted for the degree of
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ORIGINAL**

Special Dedication

I would like to dedicate this research to the loving memory of my mother, Kiryaki, who was the inspiration behind the study and to my daughter, Kismet, who with her unsurmountable patience, love and trust in me made it possible to bring it to a completion.

ABSTRACT

The aim of this research was to investigate the effect of migration to Western Europe (Germany) as an acculturation influence on the cognitive development of children from Turkey whose life experiences were formerly limited to rural and agricultural village life.

A pilot study was carried out in London on samples of Cypriot and English pupils to assess the materials to be used.

In the main study 485 children were tested. These differed along a scale in respect of their biculturation and bilingualism. At one end were children still living in Anatolia and at the other end were Turkish children who had migrated to West Berlin. The migrant children were further classified into three groups according to length of residence abroad and the types of schools being attended. A comparison group of German working-class children were also sampled.

Three general sets of hypotheses were raised on:

- a) the effects of bilingualism and biculturation on the development of cognitive skills;
- b) the order in which different skills are developed (structure d'ensemble);
- c) the relationship between language mastery (vectors versus scalars) and cognitive development.

Socio-economic status and socio-psychological attitudes of all migrant samples and the German group were also investigated.

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TABLE OF CONTENTS

Abstract
Acknowledgements
Table of Contents
List of Tables
List of Figures

Ch. 1: INTRODUCTION

- 1.1 Culture and Cognition
- 1.2 Overview of General Literature
 - 1.2.1 Perception
 - 1.2.2 Language
 - 1.2.3 Socialization
 - 1.2.4 Education and Cognitive Development
- 1.3 Overview of Present Research
 - 1.3.1 Related Studies
 - 1.3.1a Related Educational and Psychometric Studies
 - 1.3.1b Studies of Cerebral Organization
- 1.4 Organization of Dissertation

Ch. 2: THEORETICAL BACKGROUND EFFECTS OF BILINGUALISM AND BICULTURATION
ON COGNITIVE DEVELOPMENT

- 2.1 Introduction
 - 2.1.1 Bilingualism and Biculturation
 - 2.1.2 Overview
 - 2.1.3 Present Research
 - 2.1.4 Bilingualism as it relates to the Society and the Individual
 - 2.1.5 Organisation of Chapter
- 2.2 Definitions and Degrees of Bilingualism
 - 2.2.1 Types of Bilingualism
 - 2.2.1a Ambilingualism
 - 2.2.1b Natural bilingualism
 - 2.2.1c Balanced bilingualism
 - 2.2.1d Elite versus Folk bilingualism
 - 2.2.1e Bisemilingualism
 - 2.2.1f Additive versus Subtractive bilingualism
 - 2.2.1g Receptive versus productive bilingualism
- 2.3 Models and Mechanisms of Bilingual Development
 - 2.3.1 Coordinate and Compound Models
 - 2.3.2 Early versus Late bilingualism
 - 2.3.3 Simultaneous acquisition of two languages
 - 2.3.4 Sequential acquisition of a second language

- 2.4 Bilingual Speech Characteristics: Interference and Code Switching
 - 2.4.1 Interference
 - 2.4.2 Code-switching
 - 2.4.3 Code-switching in children
 - 2.5 Intervening Variables Relevant to Cognitive Development that Vary Across Bilingual Populations
 - 2.5.1 Socioeconomic Status and Cultural Environment
 - 2.5.2 Language Proficiency and Cognitive Development
 - 2.5.2a Literacy in Mother Tongue
 - 2.5.3 Threshold level hypothesis
 - 2.6 Empirical Evidence on Effects of Bilingualism
 - 2.6.1 Neurolinguistic Evidence
 - 2.6.2 Cognitive Consequences of Simultaneous versus Successive Bilingualism
 - 2.6.3 Metalinguistic Awareness
 - 2.6.4 Cognitive Flexibility
 - 2.6.5 General Cognitive Effects of Bilingualism
 - 2.7 Postscript
- Ch. 3: TURKISH VILLAGE CULTURE AND THE MIGRANT EXPERIENCE IN GERMANY
- 3.1 Village Social Structure
 - 3.1.1 Communications
 - 3.1.2 Authority
 - 3.1.3 Social Life
 - 3.1.4 Education in the Village
 - 3.2 The Village Farm Family
 - 3.2.2 Marriage in Villages
 - 3.2.3 Family Law and Tradition
 - 3.2.4 Housing
 - 3.2.5 Diet
 - 3.2.6 Equipment
 - 3.3 The Role of Religion in Village Society
 - 3.3.1 Power-authority System
 - 3.3.2 Regulative System
 - 3.3.3 Socialization System
 - 3.3.4 Value System
 - 3.3.5 Religious Beliefs and Attitudes
 - 3.3.5a Psychological Functions
 - 3.3.5b Social functions
 - 3.4 Secularization of Education in Turkey
 - 3.4.1 Literacy and Formal Education
 - 3.5 Migration
 - 3.5.1 Migrant Adjustment to City Life
 - 3.5.2 Adjustments to Western-Urban Society
 - 3.5.3 Work Environment
 - 3.5.4 Education of Migrants in West Berlin

Ch. 4: LANGUAGE AND COGNITIVE DEVELOPMENT WITHIN THE PIAGETIAN
FRAMEWORK: A SUMMARY

4.1 Piaget's Theory of Cognitive Development

- 4.1.1 Basic Assumptions of Piaget's Theory
- 4.1.2 Stages
- 4.1.3 Methode Clinique
- 4.1.4 Conservation
- 4.1.5 Rationale for the Tasks Used to Study

4.2 Role of Language in Cognitive Development

- 4.2.1 Language and Thought
- 4.2.2 Structural Aspects of Language
- 4.2.3 Functional Aspects of Language
 - 4.2.3a Representational Function
 - 4.2.3b Studies of Deaf Children
- 4.2.4 The Function of Language in Social Interaction and Communication
- 4.2.5 Role of Language in Methode Clinique
- 4.2.6 Linguistic Variables that Interact with Cognitive Development
- 4.2.7 Social Interactional Factors

4.3 Cross Cultural Research on Cognitive Development

- 4.3.1 Empirical Evidence
- 4.3.2 The Question of Structure d'ensemble
- 4.3.3 Language and Cross-Cultural Research
- 4.3.4 Research with Turkish Speakers

Ch. 5: PILOT STUDY OF LANGUAGE AND COGNITIVE DEVELOPMENT WITH ENGLISH
MONOLINGUALS, GREEK-ENGLISH AND TURKISH-ENGLISH BILINGUALS

5.1 Method of Pilot Study

- 5.1.1 Subjects
- 5.1.2 Tasks and Tests of Linguistic and Cognitive Development
- 5.1.3 Testing Procedures

5.2 Results of Pilot Study

- 5.2.1 Performance on Conservation and Classification Tasks
- 5.2.2 Searching for Developmental Structure
 - 5.2.2.a Unidimensional Approach
 - 5.2.2.b Multidimensional Approach
- 5.2.3 Use of Language and the Mastery of Conservation and Classification problems

5.3 Discussion of Pilot Study Results

- 5.3.1 Evidence from Other Sources
- 5.3.2 Linguistic Relativity

Ch. 6: RESEARCH DESIGN AND TESTING PROCEDURES FOR MAIN STUDY

6.1 Overview

6.2 Inferring Cause and Effect

- 6.2.1 Design Considerations and Strategies of Inference

- 6.3 Samples Tested
 - 6.3.1 Samples
 - 6.3.2 Specific Hypotheses
- 6.4 Piagetian Tasks and Testing Procedures
 - 6.4.1 Judgement Versus Explanation As Performance Criteria
 - 6.4.2 Contacting Samples
 - 6.4.3 Test administration
 - 6.4.4 Schedule of Testing
- 6.5 Protocol for Administration of Piagetian Tests
 - 6.5.1 Scoring of Conservation tasks
 - 6.5.2 Scoring of Multiple classification tasks
 - 6.5.3 Testing Protocol
- Ch. 7 RESULTS I: FINDINGS OF CROSS-CULTURAL ANALYSES
 - 7.1 Strategy of Analysis
 - 7.1.1 Hypothesis Testing Procedures
 - 7.1.1a Analysis of Covariance
 - 7.1.1b Example
 - 7.2 Findings on Intersample Differences in Performance
 - 7.2.1 Tests for Intergroup Differences
 - 7.2.2 Constructing Summary Measures
 - 7.2.2a Psychometric Scale Analysis
 - 7.2.3 Regression Analysis
 - 7.2.3a Formal Test
 - 7.2.3b Controlling for Sociocultural Factors
 - 7.2.4 Summary
 - 7.3 Effect of using Judgement-only Criterion in Assessing Children's Performance
 - 7.4 Structure of Development
 - 7.4.1 Scalogram Analysis
 - 7.4.2 Nonmetric Multidimensional Scaling
 - 7.5 Summary
- Ch. 8 RESULTS II: LANGUAGE AND COGNITIVE DEVELOPMENT
 - 8.1 Strategy of Analysis
 - 8.1.1 Linguistic Measures
 - 8.2 Findings
 - 8.2.1 Simple Correlations
 - 8.2.1a Age and Linguistic Competence
 - 8.2.1b Linguistic Competence and Cognitive Performance
 - 8.2.2 Partial Correlations

Ch. 9: ASSESSMENT OF RESULTS AND SUGGESTIONS FOR FUTURE RESEARCH

9.1 Hypotheses about Cross-Sample Differences in Performance

9.2 Hypotheses about Cross-Sample Variation in Structure of Development

9.3 Hypotheses about Relation of Language Mastery and Cognitive Development

9.4 Suggestions for Future Research

References:

Appendices :

APPENDIX A: Supplementary Tables

APPENDIX B: Language and the Latent Structure of Cognitive Development
International Journal of Psychology, 1976, Volume 11, p. 231-250.

APPENDIX C: Test and Task Procedures Used in Pilot Study: Version used with English Children

APPENDIX D: Test and Task Procedures Used in Pilot Study: Version used with Turkish Children

APPENDIX E: Test and Task Procedures Used in Pilot Study: Version used with Greek Children

APPENDIX F: Codebook for Pilot Study: English and Cypriot Samples

APPENDIX G: Test and Task Procedures for Main Study: Version used with Turkish Children

APPENDIX H: Test and Task Procedures for Main Study: Version used with German Children

APPENDIX I: Socio-Psychological Questionnaires Used In Main Study: Version used with Turkish Children

APPENDIX J: Socio-Psychological Questionnaires Used In Main Study: Version Used with German Children

APPENDIX K: Original Codebook for Main Study: Anatolian Samples

APPENDIX L: Original Codebook for Main Study: Migrant Turkish and German Samples

APPENDIX M: Pictures from the Villages in Anatolia-Northern Turkey

LIST OF TABLES

TABLE 4-1	Comparison of Linguistic Structure of Comparisons in English and Turkish
TABLE 5-1	Passing Rates on Piagetian Tasks for English Monolinguals, and Turkish and Greek Cypriot Bilinguals
TABLE 5-2	Rank-Order Correlations Between Dimensions of the Concrete operational stage for Three Groups of Children
TABLE 5-3	Relationship Between Use of Vector Forms of Language Pretests and Performance on the Conservation and Multiple Classification Tasks
TABLE 5-4	Regression Analysis of "Effects" Attributable to Age and Mastery of Linguistic Structure of the Comparative Upon the Development of Conservation and Multiple Classification Skills
TABLE 7-1	Percent Passing Piagetian Conservation Tasks and Multiple Classification Matrices for Samples in Main Study
TABLE 7-2	F-ratios from Analysis of Covariance (Controlling Age) of Passing Rates on Seventeen Piagetian Tasks, and Subgroup Deviations (Controlling Age) From Average Passing Rates.
TABLE 7-3	F-ratios and Age adjusted passing rates from analysis of covariance of performance of Turkish Mountain Village and Migrant Samples on each Conservation and Multiple Classification Task
TABLE 7-4a	Pearson Product Moment Correlation Coefficients between Performance on Conservation and Seriation Tasks (Using all Samples)
TABLE 7-4b	Pearson Product Moment Correlation Coefficients between Performance on Multiple Classification and Seriation Tasks (Using all Samples)
TABLE 7-5	Scale Analysis using Cronbach's Alpha for Scale Reliability for All Multiple Classification and Conservation Tasks. (Analysis using <u>all</u> children tested in main study, N = 458.)
TABLE 7-6	Cronbach's Alpha for Scale Reliability for Multiple Classification and Conservation Tasks (Computed Separately within each Subsample from Main Study)
TABLE 7-7	Regression Analyses of Effect of Age upon Performance on Multiple Classification and Conservation Tasks
TABLE 7-8	Multiple Regression Analysis of Performance on Conservation and Multiple Classification Scales as a function of Age (linear and squared) and Origin of Sample
TABLE 7-9a	Occupations of Fathers of Migrant Children
TABLE 7-9b	Religious Practices of Migrant Samples

TABLE 7-9c Occupational Aspirations of Migrant Children

TABLE 7-10a Estimates for Multiple Regression Equation predicting Conservation Performance as Function of Age, Fathers Occupation, Religious Practice, and Subsample

TABLE 7-10b Estimates for Multiple Regression Equation predicting Performance on Multiple Classification Tasks as function of Age, Fathers Occupation, Religious Practice, and Subsample.

TABLE 7-11 Correlations between Scores Obtained when Tasks are Scored Using Judgement Criterion versus Judgement plus Explanation Criterion

TABLE 7-12 Average Passing Rates for Children Aged 8 through 11 on Conservation and Multiple Classification Tasks Using Judgement-Only and Judgement-plus-Explanation as Scoring Criteria.

TABLE 7-13a Guttman Scaling of Conservation and Seriation Tasks

TABLE 7-13b Guttman Scaling of Multiple Classification Tasks

TABLE 7-14 Rank Order Correlations between Orderings of Task Difficulty derived from Guttman Scaling of Results for Total Sample and Each Subsample taken Separately.

TABLE 7-15a Pearson Product Moment Correlations between scalings of operational complexity dimension derived from nonmetric multidimensional scaling of results for entire sample and for each subsample

TABLE 7-15b Pearson Product Moment Correlations between scalings of situational complexity dimension derived from nonmetric multidimensional scaling of results for entire sample and for each subsample

TABLE 7-16 Correlations Between Factor Weights of Tasks derived from separate principal factor solutions for whole sample and for each individual sample.

TABLE 8-1 Product Moment Correlations between Language Usage, Age, and Performance on Conservation and Multiple Classification Tasks for All Children Tested

TABLE 8-2 Product Moment Correlations between Language Usage and Performance on Conservation and Multiple Classification Tasks for NonMigrant Turkish Children

TABLE 8-3 Product Moment Correlations between Language Usage and Performance on Conservation and Multiple Classification Tasks for Migrant Turkish Children

TABLE 8-4 Product Moment Correlations between Language Usage and Performance on Conservation and Multiple Classification Tasks for German Children

TABLE 8-5 Partial Correlations (Controlling Age and Age Squared) between Language Usage and Performance on Conservation and Multiple Classification Tasks For All Children Tested in Study

TABLE 8-6 Partial Correlations (Controlling Age and Age Squared) between Language Usage and Performance on Conservation and Multiple Classification Tasks For NonMigrant Children

TABLE 8-7 Partial Correlations (Controlling Age and Age Squared) between Language Usage and Performance on Conservation and Multiple Classification Tasks For Migrant Turkish Children

TABLE 8-8 Partial Correlations (Controlling Age and Age Squared) between Language Usage and Performance on Conservation and Multiple Classification Tasks For German Children

Supplementary Tables (Appendix A)

TABLE A-1 Scale Points for Multidimensional Scaling Solutions in Two Dimensions (D1 and D2) for Each Conservation and Classification Task (Computed for Total Sample and Each Subsample)

TABLE A-2 Spearman Rank Order Correlations between Nonmetric Multidimensional Scaling (2-dimensional solution) of Task Difficulty for all Conservation and Classification Tasks (for all samples combined and for each subsample)

TABLE A-3 Pearson Product Moment Correlations between Nonmetric Multidimensional Scaling (2-dimensional solution) of Task Difficulty for all Conservation and Classification Tasks (for all samples combined and for each subsample)

LIST OF FIGURES

- FIGURE 5-1 Performance on Conservation Tasks of Children Classified as Operational on Multiple Classification Tasks
- FIGURE 5-2 Multidimensional Scaling of Performance on Piagetian Tasks
- FIGURE 7-1 Analyses of Fictional Data to Demonstrate Need For Appropriate Controls for Age Composition of Samples
- FIGURE 7-2 Plots of Regression Results for Summary Measures of Multiple Classification and Conservation Performance analysed as a linear function of Age. (Separate estimates were derived for each sample, so slopes of lines were not forced to agree.
- FIGURE 7-3 Passing Rates on Multiple Classification Problems of Children who Evidenced Mastery of Conservation. (Data from main study, pilot study, and Alastair Heron's study of Serbo-Croatian immigrants to Australia.)
- FIGURE 7-4 Plots of Regression Results for Summary Measures of Multiple Classification and Conservation Performance analysed as a function of Age, Age Squared, and Sample. (analysis assuming a common age effect for all samples).
- FIGURE 7-5 Two-Dimensional Solution from Non-Metric Multidimensional Scaling Analysis Using All Children in Main Study.
- FIGURE 7-6 Two-Dimensional Solutions from Non-Metric Multidimensional Scaling Analyses Treating Each Sample Separately.

Chapter 1

INTRODUCTION

On put constater que, a intelligence egale, les bilingues avaient des resultats en d'autres facteurs -- notamment en plasticite, comme le predisait notre hypothese -- significativement superieurs en moyenne a ceux du groupe controle.
- Balkan (1970)

We shall ask, in the pages that follow, what it means, intellectually, to grow up in one cultural milieu and not another. It is, of course, a form of the old question of how heredity and environment relate: How, in this case, does intellectual development depend upon external influences; in what respects is it a series of unfolding maturational states? But the question now is in Qualitative terms. The older debate on heredity versus environment was without a possible solution. For there is no psychological phenomenon without a biologically given organism nor one that takes place outside an environment. But we can, nevertheless, study the intersection in growth of biological background and cultural milieu with the more modest aim of learning what kinds of cultural difference make an intellectual difference at what points in development and how it comes about in some particular way.

- Bruner (1974)

The sociocultural environment is of particular importance in our understanding of human cognition because human beings (unlike most organisms low on the phylogenetic scale) do not come into life with highly programmed nervous systems. The development of lower organisms is mainly the accumulation of individual experiences, and the maturation of instincts to adapt to external conditions. Man, in addition to all these mechanisms, has another kind of experience to master, 'social-historical experience' (Leontiev, 1963). What we mean by this is that since the accumulated achievements of mental development can not be transmitted from one generation to another genetically, they are passed in an external form. This social-historical inheritance and its durability within groups of people constitutes the bulk of 'culture' which can be defined as the ensemble of all skills that the individual can learn from 'his group' to face the situations that the group foresees for man's life.

Bruner (1964), has noted that much of what we mean by 'intelligence' is to a great extent the internalization of 'tools' provided by a given culture. The child is born into a predetermined world created by adults; food, clothes, habits, value-orientation, language, concepts and ideas in the language, are all controlled by his immediate surrounding. The child takes in whatever the environment has to give him by a process of 'appropriation'. (Leontiev (1963) uses this term to describe the process that others, e.g., Piaget, have labelled assimilation and accommodation.) This is the process which reproduces in the individual the historical formation of human qualities,

abilities, and characteristics of behaviour.

This process of appropriation or adaptation is an active process through which the child learns to master a (cognitive or physical) tool by using it correctly, forming the relevant motor and mental operations. This process is analogous to that described by Piaget (1952) who notes the infant's special interest in objects that are affected by his movement. Such interest can yield alterations in cognitive structure, and hence in behaviour, through a process of assimilation and accommodation. (Skinner (1953) similarly describes the phenomenon as "the operant emphasizing the environment to generate consequences").

The process of appropriation (adaptation) itself has two attributes which shall weigh heavily in this research:

- a. It occurs in varying degrees according to the conditions in which it takes place. That is to say: it is dependent on environmental factors (as is shown in the extreme cases by the examples of children reared in isolation; see review by Skuse, 1985a, 1985b).
- b. It is a more complex mechanism than simple or reflex adaptation. In the case of appropriation, what is being learned is not a fixed connection, but a flexible relationship between stimulus fields and effects that can be produced by various kinds of action. (See, for example, Piaget's discussion of the notion of schemes in cognitive development; and parallel discussions using slightly different terminology by theorists such as Leontiev, 1963; Hebb, 1949).

Since the content of the social-historical experience of the human group can only be "appropriated" in an external form, the mastery of language is of vital importance. The child in his explorations of reality is largely guided through his interactions with other people by the mediation of language. The child begins to acquire 'concepts' when his externalized actions are 'coded' by their transformation into language, and ultimately become automated in the form of simple associational acts. This basic process is fundamental to the development of more complex (inferential) thought processes such as symbolic logic. (c.f. Luria, 1963)

The motivational state underlying the development and elaboration of cognitive structure is an interesting area in its own right. There is considerable evidence to establish the existence of a uniquely relevant drive state, which has been variously labelled, 'curiosity' (Berlyne, 1955); 'exploratory motive' (Butler and Harlow, 1957); 'mastery' (Hendrick, 1942); or 'competence motivation' (White, 1959). The existence of such a drive state enables the individual to respond to any change in his environment with appropriate cognitive reorganization and effective adaptation to the new situation. This "competence motivation" is theoretically important, since it makes change, development, and differentiation possible.

1.1 CULTURE AND COGNITION

Culture consists of human customs and practices that involve economic and political systems, marriage customs and family organizations, religious beliefs, physical environment and the

ways in which people relate to each other to sustain a way of life. It is through culture that people learn to attach meaning to particular behaviours. Socialization is the process of acquiring these patterns of behaviour through interaction with adults and peers.

All human beings come into the world equipped with basic biological mechanisms, among which are drives such as hunger, thirst, sex, etc., and the need for social contact and sensory stimulation. (The latter drive can be deduced from the known fact that institutionalized infants are slow to learn to walk and talk and are physically underdeveloped in spite of adequate nutrition.) To these basic drives it has been suggested one could add a cognitive drive or "cognitive imperative". Cognition is the highest adaptive specialization characteristic of human beings. We are programmed to problem solving, conceptualization, and complex communication through language. The ability of people to impose order on their observations is manifested at every level in all cultures. We become, for example, quite anxious if we cannot impose order upon the stimuli that reach us. This need to control the unpredictable produces such cultural manifestations as religions, science, philosophy, magic, totem, etc.

Piaget has studied the development of this cognitive imperative in children starting from their basic understanding of their physical selves in relation to their surroundings. The newborn learns to modify their behaviour in response to a relatively gross perception of the environment (Piaget, 1954). The cognitive challenges offered to the child determine the

quality and articulation that will be manifest in dealing with the world. The more complex, structured, and specialized the environment, the more articulate and abstract performance will be stimulated. At the same time cultural patterns and the expected mode of behaviour influence the children in the way they think and act. Some cultures, for example, encourage independence, creativity, diversity, and being outspoken whereas in other cultures obedience to the word of the older people is revered.

The foregoing theoretical considerations as to the structure of human development would lead one to predict that diverse sociocultural environments would operate differently to elaborate the cognitive structure of the young. This will result from the gross disparities in the social-historical experiences of different cultural groups. The interaction between these diverse sociocultural environments and the individual produces the fluctuations seen in the rate and nature of the cognitive development that is manifested in the child.

1.2 OVERVIEW OF GENERAL LITERATURE

Goodenough (1971, p. 20) takes a cognitive approach towards culture emphasizing the individual within the cultural process,

People learn as individuals. Therefore, if culture is learned, its ultimate locus must be in individuals rather than in groups...Cultural theory must (then) explain in what sense we can speak of culture as being shared or as the property of groups... and what the processes are by which...such sharing arises.... We must...try to explain how this analytically useful construct relates to...the social and psychological processes that characterize men in groups.

The cultural determinants that shape the individual as a member of a sociocultural group, which reflect the differences between subgroups include:

- a. differences in the perceptual discriminations presented to the young, that is, the differences in the discriminations which the environment 'rewards' the child for. (For example, Whorf (1940) points out that Eskimos label three different varieties of snow, and thus are correspondingly more discriminative in a snowbound environment.)
- b. differences in the types and complexity of cognitive organizations applied to human experiences (e.g. the organization implicit in the language of the group)
- c. differences in the types and "aim" of external motivators used to 'control' development (parental attitudes toward childrearing practices, peer group values, type of education, etc.).

Through such mechanisms the varying sociocultural histories of human groups would be preserved in the differing cognitive structures of their successors.

Evidence in support of such predictions has been provided by observational studies of cognitive development in different cultures, and in different socioeconomic groups within the same culture. Unfortunately, such nonexperimental studies can only observe an "association" between environment and cognitive development. Experimental studies with animal populations, however, have yielded some results in consonance with those we predict for human populations.

1.2.1 Perception

Fairly extensive research has been carried out on the impact

of environmental factors upon the perceptual development of the neonate. Gibson and Walk (1956) have demonstrated that prolonged exposure to visual patterns in infancy significantly improves the rate at which rats learn discrimination tasks which involve these patterns. Similarly, Forgas (1955) has conducted studies indicating that the animal:

...whose early experiences are qualitatively more complex, are superior at problem solving when external stimuli are reduced, and they are able to change their reaction sets more readily when the solution demands such a change.

Such findings led Hebb (1958) to conclude that lack of complexity and varying stimulus environments impairs the arousal functions of the reticular system which may lead to resistance to sensory input and perceptual activity.

Observational studies of human neonates have found an association between the diminished sensory stimulation of institutional life and the retardation of cognitive development (see review by Skuse, 1985b; for examples of cases, see Skuse, 1985a; Davis, 1940; Dennis, 1960). In a controlled study of the effects of visual enrichment of neonatal environments, White (1966) has demonstrated its beneficial results upon children's cognitive development. Moreover, White's results have suggested that even a too complex stimulus is preferable to no stimulus at all (cf. White, Castle, and Held, 1964). Indeed, it is even found that much of the retardation of development caused by extreme isolation in childhood can be reversed by providing suitable remedial stimulation. As Skuse (1985b) writes:

Fortunately, the evidence reviewed suggests that, in the absence of genetic or congenital anomalies or a history of gross undernourishment, victims of such isolation have an excellent prognosis. . . . Theoretical observations include the implication that most human characteristics, with the

possible exception of language, are strongly 'canalised' . . .and hence virtually resistant to obliteration by even the most dire early environments. On removal to a favourable situation, the remarkable and rapid progress made by those with good potential seems allied to the total experience of living in a stimulating home and forming emotional bonds to a caring adult (p. 567).

Other cross-cultural research suggests that very general characteristics of the physical environment of specific human populations have an effect on perception of its beholders (Segal, Campbell and Herkovits, 1966). People tend to organize and make inferences using the cues prevailing within an environment in order to function effectively, this in turn leads to mastery of skills necessary to cope with the physical world. Dasen (1975) studied three subsistence economy populations (Canadian Eskimo, Australian Aborigines, and Ivory Coast Africans). His findings support Berry's model of cognitive differentiation indicating that ecology selectively enhances specific learning. With respect to the mastery of skills, the cross-cultural research in perception and cognition show group differences in the perceptual and cognitive skills developed by people to meet their particular ecological and cultural problems (e.g. Berry, 1966, 1976; Dawson 1967; MacArthur, 1973, 1975; Vernon, 1969).

1.2.2 Language

Differences in the complexity of cognitive organizations applied to human experience is also reflected in the language spoken by that particular group of people. Language, is a powerful tool, not only for communication but also for encoding reality, representing matters remote as well as immediate,

according to rules intrinsic in its own structure. Language permits us to represent reality around us and to symbolically transform it.

Cross-cultural studies enable us to study the process of categorization and extraction of similarities in the face of different cultural phenomena (See Lonner, 1980, p. 162). Many studies have been undertaken to study the relationship between language and cognitive performance. Bruner et al. (1966), for example, conducted the well-known experiment with Wolof children and found that the ease of naming colors facilitates classification. The fact that their Wolof-French bilingual children made fewer errors at every age than monolingual Wolof children suggests the significance of lexical tools (e.g. more highly differentiated lexicons) for successful performance on a cognitive task. Similarly, Brown and Lenneberg (1954) found that subjects recognize colors more readily in a large array when suitable labels are available in the subject's linguistic repertoire.

Syntactic properties of language that relate to the logical structure of thought emphasize grammatical encoding. These properties force certain classificatory and discriminatory dimensions of experience on the speakers of a given language. The category systems embodied in a language identify aspects of the environment that provide direction for instrumental activity, and anticipate future events (see Spradley, 1972, p. 24). Data collected by Basso (1972) among Slave Indians living in Northern Canada, for example, show that the Slave have a highly differentiated classification for ice. The matrix of

environmentally crucial aspects of the state of the ice is elaborately encoded within the structure of the slave language. Since the description below is quite revealing of the nature of this complexity, the text deserves to be quoted at full length:

Ice is divided into three main subcategories: solid ice, melting ice and cracking ice, which are directly related to the function of travelling over it. There are further terms within each subcategory.

Thus solid ice has eight further discriminations: "thin ice," "brittle ice," "hollow ice," and so on. This is akin to the well known nomenclature among Eskimos of categorizing different shades of snow, and can be elicited directly from the language. However Basso goes one step further into the structure underlying the criteria for ice by using a modified version of the paired comparison tests used by Berlin, Breedlove, and Raven (1968). It turns out that there are a whole group of morphological attributes of ice that contain the following criteria: state, subsurface water, surface water, texture, thickness, clarity, color, and states of the cracking process.

Morphological properties of ice constituted only one side of the coin. The other side constituted the situations wherein ice is encountered: that amounts to kinds of travel. There is a general term for travel; more specifically it is put in a participating sense, "travelling from place to place," pertinent to winter hunting and trapping. This generic term is subdivided into three kinds of "travelling from place to place": namely, "travelling on foot," "travelling by snowshoe," and "travelling by dog sled." The properties of ice are now correlated to the specific kind of travelling, as it apparently made no sense for the Slave to be asked "what kinds of ice are suitable for travel?" Such a question had to be asked only with reference to the specific kind of travel -- by foot or by dog -- sled, for instance. The resulting matrix of questions, formed by the conjunction of the various types of ice with the various types of travel, could then be made for Slave informants, asking them to respond in appropriate terms. These appropriate terms, found out also by empirical study, were put in terms of function for the informant. There were three such appropriate responses. The ice was judged suitable for that kind of travel and could therefore be traversed. The ice was judged unsuitable and a detour was considered necessary. Or the ice was considered dangerous and could only be traversed with caution.

Besides the cross-cultural work, considerable research has

also been done on the acquisition of language skills among children of varying socioeconomic groups within the same culture. Numerous studies (e.g., Kellner et al, 1958; Davis 1937; Templin, 1953; Thomas, 1962), report a strong association between the child's language facility and the socioeconomic status of its parents. In considering the importance of this phenomenon in Western societies, Bernstein (1971) has distinguished between 'public' and 'formal' language, corresponding respectively to the (accustomed) speech of upper and lower classes. Public language (restricted code), according to Bernstein, provides a communication medium of low cognitive complexity whose lack of "rational" challenge inhibits cognitive development. Formal language, on the other hand, points to the possibilities inherent in a complex conceptual hierarchy for the organization of experience. Bernstein's orientation together with the consistent findings of social class differences in language behaviour points to an important link between environmental conditions and cognitive development.

1.2.3 Socialization

Further observational studies of the socialization of the young in Western societies provide evidence that certain types of environmental restriction co-occur with retarded cognitive development. Bronfenbrenner (1970) in a summary of American research in child-socialization concluded that the lower classes are consistently more authoritarian, and more prone to use corporal punishment and absolute demands for obedience, while the upper classes make more use of reasoning, guilt, and appeals to

the child's sense of social responsibility. A simple mechanism may be postulated to "explain" the covariation of these modes of child training and the levels of children's cognitive development, i.e., that exposure to rational "demands" trains the child in conceptual activities, while arbitrary demands for obedience to authority convey no such training and thus restrict development. Elaboration of this finding has been provided by research of Miller and Swanson (1966), Kohn (1959), and Heinicke (1953).

In addition to the environmental effects implicit in the types of authority structures employed by different sociocultural groups there are the more overt environmental restrictions resulting from the different economic conditions of the varying populations. In the West we know that generally the economically poorer homes have fewer books, fewer educational toys, and provide less opportunity for even simple manipulations of household objects (Stone and Church, 1968). In short, the totality of the lower class environment operates against natural curiosity and free interaction with the environment. As Edwards (1976:145) observes, the lower class child "has special difficulties in learning because his curiosity has less often been rewarded and his questions have less often been answered in ways directly relevant to them."

1.2.4 Education and Cognitive Development

Extensive research has been undertaken in the last decade to detect the differences in the types and aim of external motivation to "control" cognitive development. We know that many

skills are learned and developed through contact with other members of one's culture. Primitive skills of manipulating, looking, and attending are learned through the interaction of parent and child. Development of further competence skills depends upon the demands of that specific culture. Formal schooling prepares the child for hierarchical development where the sequence of learning is important in order to master more complex organizations. The perceptual and cognitive skills required by a highly industrialized and technological life style are often said to be quite different compared to the skills appropriate for a rural subsistence culture. If this is true, some environments may slow the acquisition of new skills, others prepare the individual for further discrimination, differentiation, and integration leading to higher cognitive complexity (see Bruner, 1971).

Bruner considers education as "an agency for empowering human minds" (1971, p. 523). He concludes that in the absence of education "one finds forms of intellectual functioning that are adequate for concrete tasks but not so for matters involving abstract conception. In short, some environments "push cognitive growth better, earlier and longer than others" (Greenfield and Bruner, 1969, p. 654; see also, Dasen, 1972, 1977, 1978). Especially in disadvantaged cultural settings we come to rely on formal education to direct the human mind to more complex interactions. Formal schooling is also thought to teach the Western self-consciousness which enables children to distinguish between thought and the object of thought necessary for symbolic operations and also to distinguish between self and

other (Dasen, 1977). Schooling with its emphasis on written symbols forces children to use language in abstract grouping operations that remove the objects from their immediate context of reference (see also Vygotsky, 1962).

Education and other cultural factors appear to play a potent role in cognitive development. Cole, Gay and Glick (1968) have observed that uneducated Liberian children and adults tend to be less skilled than Liberian school children on sorting and classification tasks. They also observed that American and Liberian school children do perform similarly, on some types of sorting tasks, e.g., learning to identify objects on the basis of some feature. Carraher et al. (1985) present evidence that (largely uneducated) lower class Brazilian children are deficient in formal mathematical skills, although they are competent in solving many "real-life" problems using other strategies even though they cannot solve the same problem when it is presented in an abstract form (e.g., 12 times 5 equals __? versus If apples cost 12p each, how much do five apples cost?).

Bruner (1973, 1974) has noted that some cultures strongly suppress any expression of individualism as an attitude toward life. Bruner (1974: 46) writes that:

It may be that a collective rather than individual value orientation develops where the individual lacks power over the physical world. Lacking personal power, he has no notion of personal importance. In terms of cognitive categories, he will be less likely to set himself apart from others and the physical world.

This tendency prepares one to accept phenomena whether they be social, physical, or psychological either as they appear to the eye or as they are interpreted for the group by authority figures. Rabain-Zempleni (1965) and Gay and Cole (1965, 1967)

have observed that in such cultures children say that the facts are true "because the teacher says so." There is no self-initiated understanding and probing into facts to establish truth for oneself.

Similarly, Fortes (1938) observed that Tale children rarely asked "why" questions. Kirk (1976) compared maternal teaching techniques among rural, urban, and suburban samples in Ghana and found that verbal justification and explanation was rarest in the rural sample where traditional education was most important. Goody (1978) and Ghuman (1982) have suggested that the prevailing norm in such cultures is that a person of relatively high status (e.g. a teacher) questions a person of relatively low status (e.g., learner) but not vice versa. Children who are subject to such cultural norms refrain from what is considered to be "unnecessary questioning" of adults, and they thus lag behind children in cultures where such questioning is welcomed and positively rewarded.

1.3 OVERVIEW OF PRESENT RESEARCH

The foregoing evidence gathered from observational studies of human subjects, as well as the experimental evidence obtained from animal subjects, are consistent with the notion that environment can influence the cognitive development. Three mechanisms were cited to explain how the disparate sociocultural histories of different populations could cause differentials in cognitive development. It has been seen that these mechanisms are capable of mediating the effect of environment upon the development of the child.

Most of the cross-cultural studies, however, only report differences in the mean ages at which competency in various mental operations are attained. Since these studies are essentially descriptive in their nature they do not permit us to make firm causal inferences about the relationship between particular aspects of culture and differences in cognitive development.

The present study provides us with a unique opportunity for a quasi-experimental study to assess the effects of environment on cognition. Our study is conducted within the framework of Piaget's theoretical formulations. Piaget himself has emphasized the need for such research:

Psychology elaborated in our environment, which is characterized by a certain culture and a certain language, remains essentially conjectural as long as the necessary cross-cultural material has not been gathered as a control. Piaget (1966, p. 12).

Piaget (1974:300-303) suggested that cross-cultural research may provide the possibility of distinguishing the relative influence of four factors in the development of cognitive functions:

1. Biological factors (interactions between the genotype and the physical environment);
2. Equilibration factors (the significance of exercise and of acquired experience in the actions performed on the environment and the sequential forms in general coordinations of such actions, e.g., conservation);
3. General social factors of interpersonal coordination (interaction among children or between adults and children involving exchanges, cooperation, and competition);
4. Factors of educational and cultural transmission (i.e., coordinations of collective actions and transmission of such structures crystallized in a specific cultural setting).

The present research focuses on the influence of biculturation (European contact and residence in an industrialized milieu) and bilingualism in cognitive development. It thus is mainly concerned with the third and fourth of the factors Piaget posits to affect cognitive development.

Most past studies in cross-cultural Piagetian psychology have dealt with these factors by studying samples of rural children and comparing them to urban-dwelling children within the same culture (e.g. Greenfield, 1966; Peluffo, 1967; deLacey, 1970; Mohseni, 1966). Generally, some developmental delay is found; Mohseni, (1966), for example, notes a systematic delay of two or more years for the attainment of the concrete operations between country and city children, but these operations appear at about the same ages for urban children in Teheran and in Europe (Geneva).

The Piagetian literature on cognitive development (and the related cross-cultural research) traditionally holds that the sequence in which children develop basic cognitive competencies is universally invariant (see, for example, Shayer, 1985; Modgil, 1976; Hyde, 1959; Goodnow, 1962; Price-Williams 1961; Boisclair, 1973; Almy, 1970; Lloyd, 1971; and reviews by Dasen, 1972, 1977). Anomalies have, however, been reported with bilingual subjects (e.g., Heron and Dowell, 1974; Kelley et al., 1973; Sevinc and Turner, 1976). Piagetian research on the relationship of language acquisition to cognitive development (see, for example, Sinclair de Zwart, 1967, 1973, 1976; Berthond and Sinclair de Zwart, 1978; Beilin, 1976; Rosenthal, 1979) has demonstrated the existence of some systematic associations between linguistic and

other cognitive development. The interpretation of these findings is, however, a subject of considerable theoretical controversy. For example, one wonders: whether language acquisition is a precondition for other types of cognitive development? whether abstract reasoning¹⁹ is possible in the absence of language? and so forth.

In the pilot work (see Chapter 5) for this research project, we too found significant relationships between certain aspects of language acquisition (mastery of scalar and vector forms) and children's cognitive development. While these relationships persisted when age was controlled, the direction of causality, if any, could not be determined with the available (cross-sectional) data.

Other research that is potentially relevant to the present study can be found in the (non-Piagetian) educational and psychometric literature, and also in the literature describing neuropsychological research on the cerebral dominance of language in bilingual versus monolingual subjects. These areas of research are briefly summarized below.

1.3.1 Related Studies

1.3.1a Related Educational and Psychometric Studies. Studies of the relationship of bilingualism to children's cognitive development and educational performance have a long history. Historical concern with this topic in North America was probably motivated by the need of educators to serve the children of successive waves of immigrants to the United States. Many of these older educational/psychometric studies were seriously

flawed because the English language competence of the supposedly "bilingual" children was weak. In fact, most of these studies only served to show that "bilingual" children of immigrants were less intelligent than the native born when tested in English using a verbal IQ measure (see reviews by Darcy, 1953; Lambert and Peal, 1962).

More recent work in Canada (e.g., Lambert, 1981; Lambert and Tucker, 1976; and see also the review by Gardner and Desrochers, 1981), Ireland (Macnamara, 1966), and Swiss (Balkan, 1970) shows little evidence of any "negative" effect of bilingualism, and this work has produced tantalizing, but not entirely consistent, evidence of "positive" effects of bilingualism. In particular, fragmentary evidence suggests that bilingualism may increase "creativity" or intellectual "flexibility" (at least in the early years).

Balkan (1970, p. 101), for example, concludes from his data that bilinguals show greater cognitive "flexibility:"

On put constater que, a intelligence egale, les bilingues avaient des resultats en d'autres facteurs -- notamment en plasticite, comme le predisait notre hypothese -- significativement superieurs en moyenne a ceux du groupe controle.

Similarly, Lambert and his collaborators reported significant associations between bilingualism and scores on tests of "divergent thinking," in the early years of their research (although this result dropped below significance in later years; see Barik, Lambert, and Tucker, 1974). Other evidence is found in the work of Landry (1974), Feldman and Shen (1971), Cummins and Shaw (1978), Oren (1981), Barik and Swain (1976); and see

also the excellent reviews by McLaughlin, (1977; 1978, ch. 7; 1982). There have been several studies done at the Institute of Education, University of London (Totterman, 1979; Georgecopolou, 1984; Baluch, 1984; Ozzi, 1983). Bilingualism also remains an important issue of public policy in many areas of the world. [See, for example, the study by the Language Minorities Project (1983) for a British perspective on this topic; European Communities Council (1977) in Bruxelles and also see President's Commission on Foreign Languages and International Studies (1979a, 1979b) for an American perspective.]

The present study is relevant to this body of Piagetian research because it could provide convincing evidence of variability in the sequencing of cognitive development, at least within the "concrete operations" stage. It also provides a quasi-experimental basis for the inference of a causal effect of second-language learning and biculturation upon cognitive development in young children.

1.3.1b Studies of Cerebral Organization. More speculatively, we would take note of a recent genre of "hemispheric specialization" research which claims to have demonstrated neuropsychological differences in the language function of bilinguals. Albert et al. (1978), for example, conclude their monograph on the Bilingual Brain with the assertion that:

Language is organized in the brain of a bilingual in a manner different from that which might have been predicted by studies of cerebral organization for language in monolinguals. Studies of monolinguals have indicated that the left hemisphere is dominant for language in most individuals. Studies of bilinguals demonstrate not only that left hemispheric role in language but also a major right hemisphere contribution.

The facts of bilingualism indicate that the right

hemisphere plays a major role in the learning of a second language, even in adulthood. Further the brain is seen to be a plastic, dynamically changing organ which may be modified by processes of learning. The brain does not have a rigid, predetermined neuropsychological destiny. The learning of a second language may alter patterns of cerebral organization even for the first-learned language. (p. 243)

Other evidence for these propositions is generally mixed (see review by Springer and Deutsch, 1985; and studies by Vail and Lambert, 1979; Ojemann and Whitaker, 1978; Kinsbourne, 1981; Galloway and Scarcella, 1982). While any linkage must be considered highly speculative, the discovery of an alteration in the process of cognitive maturation for bilinguals might be taken by some as a possible behavioural expression of the variations alleged to exist at the neuropsychological level.

1.4 ORGANIZATION OF DISSERTATION

The aim of this cross-cultural research project was to assess the influences of migration to a highly industrialized setting (and the attendant bilingualism and biculturation) upon the cognitive development of young children. In Chapters 2, 3, and 4 we review literature relevant to our study. Chapter 2 reviews relevant studies of bilingual language acquisition and its consequences. Chapter 3 describes the nature of the village culture in Turkey (the culture^{of} origin of our subjects) and the experience of migration from that culture to the industrial areas of Western Europe. In Chapter 4 we discuss relevant aspects of Piaget's theory of cognitive development; this theory provides the framework for the tests of cognitive development used in our research.

Chapters 5 and 6 present details of the research design and our preliminary experiences using these research methods prior to beginning the main study. Chapter 5 reports on a pilot study conducted in London with Turkish Cypriot, Greek Cypriot, and English children. This pilot study provided an opportunity to use the Piagetian testing procedures with a Turkish-speaking population of children, and it also provided substantive results that had an important impact in refining the theoretical focus of the main study. Chapter 6 describes the research design used in the main study and discusses the problems of inference that arise in this and similar non-experimental research projects. Chapter 6 also describes the testing and scoring procedures used in the main study.

Chapters 7 through 9 contain the results of the main study. Chapter 7 presents a variety of statistical analyses designed to test whether there were cross-cultural (or cross-linguistic) differences in the results obtained from our samples of migrant and non-migrant children. Chapter 8 analyzes the relationship between certain aspects of language mastery and cognitive development. Finally, Chapter 9 summarizes the major findings and conclusions of our analyses.

Chapter 2

THEORETICAL BACKGROUND EFFECTS OF BILINGUALISM AND BICULTURATION ON COGNITIVE DEVELOPMENT

Dennis the Menace, explaining to one of his little girl friends the meaning of what he mispronounced as bi - lingal:

"You see, it means that you say the same thing twice, only one time you understand it, but the other time you don't."

-J. Haugen (1978)

2.1 INTRODUCTION

2.1.1 Bilingualism and Biculturation. Bilingualism and biculturation have become increasingly important issues in recent decades due to the increased mobility of populations between nations with diverse languages and cultures. The consequent displacement of these populations for economic and political reasons from their countries and cultures of origin poses an important set of questions both for the nations involved, the individuals and their children, and for those psychologists interested in issues of language and culture.

The migrant populations come with a set of cultural traits and a "first language," and they then learn another set of cultural rules, traits, and so forth as well as the most visible

aspect of the new culture -- its language.

The functional transition from monolingualism to bilingualism has been studied by many researchers motivated, in part, by the societal and educational demands the migrant populations made upon the new culture and by the adaptations that were seemingly required in the culture's educational system. The nature of these concerns is not restricted to such cases as: the third-world migrant labourers in Europe, the Asian immigrants in Britain and the Hispanics in the United States, but it is crucial to educational (and national) policy in every multicultural society. Thus, linguistic policies and the education of national minorities has been a key issue in the republics of the Soviet Union -- where Russian is a second language to the Uzbeks, Latvians, Azerbeyjani, and so forth. Similarly, the status of minority languages has been a source of friction in countries as diverse as India, Canada, and the Arab nations of North Africa. For example, in North Africa, the colonial experience left much of the Algerian, Morroccan and Tunisian intelligensia (and the first post-independence generation of children) largely illiterate in their "native" Arabic. The language of prestige, higher education, and state administration was French during the colonial and immediately post-colonial period. In my own experience, it was common to find university-educated Algerian government bureaucrats complaining in the early 1970's of government-mandated programs requiring Arabic literacy for state bureaucrats.

In studying bilingualism, it is probably essential that researchers extend themselves beyond their customary frames of

reference in interpreting and understanding the phenomena under study. There is a strong emotional tie between language and nationality (and, to be sure, popular notions of "race" or "ethnicity"). Even in polyglot cultures like the United States and the Soviet Union there is a strong tendency to equate mastery of the dominant language with being really Russian or American. The exceptions to this rule arise in countries -- like Switzerland -- where the power and the numbers of the population divide more or less equally between two or more languages. And even here, the situation is little different for residents who do not speak a "major" language. It is, for example, difficult to detect any greater "tolerance" by the Swiss of the linguistic and cultural diversity of their "guest workers" from the third world than shown by the Germans who do not traditionally think of themselves as a polyglot nation.

It is very easy for the researcher to fall prey to the convenient assumption that there may be something superior or convenient or functional to trading mastery of the language of a host culture for loss of one's mother tongue. Stated as a bold generality, such a proposition is a question of values and not the substance of science. For the researcher who aspires to something beyond politically inspiring generalities, the questions must revolve around specific sorts of outcomes for the people and nations involved, and keen attention must be paid to accounting both for benefits and for losses which may result from any specific strategy.

2.1.2 Overview. Current linguistic theories tend to deal with a single language in the mind of a speaker, concentrating on the

structure of language and the nature of its acquisition while neglecting the broader issues of language use (Hymes, 1972:272). Bilingualism, in contrast, inherently involves the presence of more than one language in the mind of the speaker -- no matter how these languages are structured or acquired. It would be most challenging to be able to draw out specific features of bilingual performance that would allow us to keep track of underlying linguistic structures, if they exist, be it in the neurological or cognitive sphere. This however has not been achieved, to my knowledge, in any past research. Thus, the question which must be asked is whether the basic principles discovered in studies of language acquisition and cognitive development for the monolinguals will generalize to situations where two (or more) languages are acquired. Or, to state it in another way: do we encounter different patterns of development in bilinguals than have been reported for monolingual subjects? If the answer to this initial question is yes, then we would like to know what conditions play a role in bringing about this distinctiveness of the bilingual. If we could answer the second question we might then be in a position to manipulate the relevant conditions to achieve a desired outcome. Were we successful in all of the above (i.e., finding differences in between monolinguals and bilinguals in cognitive development, elaborating the mechanisms involved in producing these differences, and demonstrating the adequacy of our knowledge by experimentally manipulating these conditions to produce predicted results) we might then state conclusions that may have strong implications for educational practice and thus may be of general interest in the sociopolitical arena.

2.1.3 Present Research. The present research is intended as a first step to investigate effects of bilingualism on cognitive development. It was hoped that a careful study of a large number of children who more or less randomly acquired second languages and cultures with different degrees of competence (when compared to monocultural and monolingual children from their origin and destination cultures) would provide evidence on the first of our questions:

Are there differences in the cognitive development of children who undergo the experience of bilingualism and biculturation?

The nature of our samples and the seeming accident of the timing of migrations and the assignment of children to different types of schools in Germany leaves us in a position to offer relatively strong evidence on this question.

2.1.4 Bilingualism as it relates to the Society and the Individual. Because of the complexity of the nature of bilingualism, we have to look at the nature of the phenomenon in a multidisciplinary way. One aspect of the study of bilingualism involves the sociology of being bilingual, in other words, who speaks what language to whom and where? (see Fishman, 1965) To answer such a question requires one to look at the domain of language behaviour, the relationships of groups in interaction, the social settings of the interactions, and so forth. This is an area that has been well researched by Basil Bernstein and his colleagues in the case of the monolingual English child (e.g., Bernstein, 1973). It is however an area that is beyond the scope of the present research.

A second aspect of bilingual functioning could be termed the

socio-psychological aspect involving the interaction of the individual with his changing environment. Even though one can hypothesize that an individual could become bilingual in some sense of the word while ignoring other aspects of the culture whose language he is learning, this individual will soon find himself in conflict with the norms, values, and customs of that culture if he is in a position to use his new language in everyday life. We thus are practically forced to confront the issue of biculturation -- an essential fact of life for almost every bilingual -- and certainly one for every migrant bilingual. In order to function in a second culture the migrant must not only learn a language but must also come to learn the rules, norms, values, and customs of that culture. Without such biculturation, the language of the migrant may be thought vague, strange, inappropriate, or worse -- even though the utterances are grammatically and lexically correct. For effective communication a speaker must adjust "to the linguistic cues as coinciding with the cultural implications within a culture" (Beardsmore, 1982).

Additionally, the neuropsychological and neurolinguistic aspects of bilingualism involve the study of structural and functional regulation of bilingualism by the brain. The organization of first language acquisition has over the last decades been shown to be regulated by the left hemisphere of the brain (Lennenberg, 1967). It has been claimed (Albert and Obler, 1978) that with the acquisition of a second language the right hemisphere may take over the first language -- and so the language of the bilingual may be more bilateral than that of the

monolingual. As noted in Chapter 1 (Introduction), there is a small body of new evidence suggesting that this is so, and that this may account for some of the seeming cognitive "flexibility" of bilinguals (see, for example, Vail and Lambert, 1979; Ojemann and Whitaker, 1978; Kisbourne, 1981; and see also Krashen 1978, p.87 for discussion of left cerebral hemisphere dominance in language processing).

Each of these aspects of bilingualism which are available when one takes a multidisciplinary perspective present challenging and relevant hypotheses that will deserve testing if we are to achieve the sort of knowledge required for confident crafting of educational policy. These, however, are matters which are beyond the scope of the present research. To make the present research manageable we have focused on the development of cognitive abilities in bilingual children. Past research in this area has mainly focused on IQ tests or other measures of scholastic ability comparing bilingual and monolingual populations (See Darcy, 1946; 1953; Lambert and Peal, 1962). More recently, some researchers have been investigating cognitive correlates of bilingualism and they have begun to probe into the nature of the cognitive processes in bilingual versus monolingual children.

2.1.5 Organisation of Chapter. In considering theoretical matters related to our work in this chapter, we will begin by looking at definitions and types of bilingualism (Section 2.2). Then we will describe models for second language acquisition and bilingual functioning (Section 2.3) followed by a consideration of the characteristics of bilingual speech, e.g., cross-language

interference and code-switching in the bilingual's language use (Section 2.4). Subsequently, we will continue with a consideration of intervening variables that may affect the relationship between bilingualism and cognitive development (Section 2.5) and then review the empirical evidence on the overall relationship between cognitive development and bilingualism (Section 2.6).

2.2 DEFINITIONS AND DEGREES OF BILINGUALISM

Earlier studies that have treated bilingualism as an independent variable have not taken great notice of the variations in second language ability of bilinguals. Their failure to do so raises some questions about the results they report, and it is possible that some of the discrepancies found between research studies may be due to differences in the definition and choice of bilingual samples. In some cases a Mexican-Spanish or Italian surname was a good enough indication to classify the subject as bilingual (see reviews by Darcy, 1946, 1953; and McLaughlin, 1978). In other instances all children who lived in a home with at least one family member who was a native speaker of a foreign language was classified as bilingual (Lee, 1932).

Bloomfield (1935) defines bilingualism as "a native-like control over two languages." Leopold (1939) has emphasized the practical use or functionality of the two languages in question regardless of their being equally well spoken. Haugen (1953) states that bilingualism is present when a speaker utters complete meaningful words or phrases in any other language. In

later years Haugen (1968) required a "native competence in more than one language." Others have a broader definition wherein a speaker is bilingual "if he understands the foreign language without being able to speak it" (Pohl, 1965:344; Diebold, 1964:469). This approach is taken further by others such as Gumperz (1969:243) who takes those people with "a command of different varieties of the same language as "socially bilingual" (diglossia).

Macnamara (1969:82) has pointed out four aspects of language competence: listening, speaking, reading, and writing, in relation to semantic, lexical, phonological, and syntactic aspects of language. According to him, anyone who possesses at least one of the above-listed competencies can be considered bilingual.

The disadvantage of such a broad definition of bilingual competence is severe where cognitive competence is also an issue. Surface proficiency in a language (i.e., structural, grammatical, and qualitative competence) may be misleading in determining the ability to use language as an effective instrument of thought. The "cognitive performance," for example, of receptive and productive bilinguals, would no doubt be functionally different when tested even when their actual cognitive competences were identical. When dealing with bilingual populations with varying linguistic competencies in their second language, there does not seem to be a common standard for making inter-study comparisons since the definitions of "bilingual" competence have shown such wide variation.

In the present research, we therefore chose to confine

ourselves to intra-study comparisons where the definition of bilingualism was defined by the child's day-to-day participation in integrated classes (taught in second language) versus segregated classes (taught in mother language), and for the "segregated" children by their length of exposure to German language and culture. Furthermore all testing of children in the present study was done in the child's native language.

An alternative approach to the definition of bilingualism found in the literature is also derived from a more functional point of view (see, for example, Mackey, 1970:555). This viewpoint focuses on the actual use of (rather than mere competence in) a second language. In a related but somewhat different approach, O'Doherty (1958) has made a distinction between true bilinguals and pseudo-bilinguals, emphasizing the positive advantage of being a true bilingual. Rivers (1969:36) suggests a more complete definition combining competence and function by saying we should "consider the child bilingual as soon as he is able to understand and make himself understood within his limited linguistic and social environment."

The latter definitions, as Skutnabb-Kangas (1981:87) emphasized, broadens the sphere of competence from a linguistic (structural) to a more sociolinguistic (communicative) approach and further takes it into the psychological sphere where language is treated as an instrument of thought (Bruner, 1975; Olson, 1977; Cummins, 1977:78). The languages used by a speaker within a given environment should meet the individual and societal demands for effective performance on both sides. The individual demands are an internal function of the language and provide a

means for "cognition, investigation, reflection, and consciousness" (Skutnabb-Kangas, 1981). The societal demands are those social cues coming from the majority language and culture. The linguistically handicapped speakers have a disadvantage in satisfying these two functions depending on where they stand in their development of Language 1 and Language 2 competence.

In concluding our discussion of definitions of bilingualism we should note the more "attitudinal" measures. These essentially ask speakers for their preferences of a language they would like to speak of those they know (see, for example, Bentahila, 1983: Ch. 4). It is not sensible to talk about such measures as indicating bilingualism -- rather they indicate whether the language preferred is the home language or the language of the dominant culture (for migrants).

2.2.1 Types of Bilingualism

Among the different types of bilingualism that we will concentrate our attention upon are the following (which will be discussed in greater detail below):

- A. Ambilingualism
- B. Natural Bilingualism (primary) versus school/cultural (secondary) bilingualism
- C. Balanced versus non-balanced bilingualism
- D. Elite versus folk bilingualism
- E. Bisemilingualism
- F. Additive versus subtractive bilingualism
- G. Receptive versus productive bilingualism

As we have seen in the previous discussion there are various

definitions of bilingualism that fall between a minimal to a maximal level along the continuum of bilingualism. There is thus a need to differentiate between the types of bilingualism in order "to clarify some of the ambiguities inherent in overgeneralized definitions" (Beardsmore, 1982).

2.2.1a. Ambilingualism is the perfect acquisition of two languages that are used interchangeably in all relevant contexts. The equal command of two languages is considered true bilingualism by Thiery (1976), and it also corresponds to the viewpoint of Halliday, McKintosh, and Stevens (1970) who emphasize a "maximalist" approach (competence in all linguistic skills). (See also Beardsmore, 1982.)

While the notion of interchangeability of language use may seem on first consideration to be a theoretically appealing notion when defining true bilingualism, it is in actuality quite unrealistic. Cultures are not mirror images of one another and thus languages are never perfectly interchangeable for the expression of one's concepts and thoughts. (Indeed it is a well known observation that there are concepts which are unique to one language and cannot be easily nor well expressed in another language, e.g., attempts to express the Greek concept of *philotimo* in English; see Triandis 1972, 1980.) Thus it is not unusual that differences in the histories, geographies, social structure of different peoples through the ages has come to be reflected in the languages spoken and thus offer different opportunities for expression to speakers of different languages.

2.2.1b. Natural bilingualism (versus school bilingualism):
Natural bilingualism, also known as primary bilingualism

(Houston, 1972) is exemplified by someone who has learned two languages in the course of everyday life (without systematic instruction being given as an aid to acquisition). Such natural bilingualism may commonly occur in two language homes, homes where the (single) household language differs from the language of society due to immigration to a foreign country or other similar circumstances.

In contrast, school bilingualism is acquired through formal instruction in a second language. The important differences between school and natural acquisition of bilingualism are the immediacy of use of the new language in day-to-day life and the learning of grammatical rules and a lexicon through experience rather than the more abstract process of learning transformational rules and a vocabulary for translating concepts of the first language into the second language. A special case of the "school" bilingualism is a so-called cultural bilingualism which involves a more extensive formal study of the language together with a learning of the aspects of the culture that are (directly) relevant for use of the second language, e.g., studying literature or history in the second language.

Both school and cultural bilingualism are generally categorized as "secondary" bilingualism. In contrast, most researchers regard natural bilingualism as a primary or "true" bilingualism wherein the speaker is forced to communicate through both his languages in order to deal with the individual and societal demands he faces from his early years on. This type of bilingualism has been claimed to have both positive and negative effects on speakers (from psychological and sociological perspectives).

2.2.1c Balanced bilingualism is conceived as mastery of two languages equally well so that either language can be used interchangeably in a given situation in spite of the occasional interferences and borrowings from the second languages. Even though the use of the two languages is potentially interchangeable in theory, it is not the case in fact that the language competence of the balanced bilingual will be in all respects a mirror image of the perfect mastery of the monoglot. Indeed, it is important to note that the methods used for measuring "balance" consciously exclude subjective judgements of fluency or verbal proficiency. The common measure uses the ratio of words produced (in free speech) in Language 1 to those produced in Language 2. Since it is the ratio of words that is looked at, neither verbal proficiency, accent, nor IQ are confounded with this measure of "balanced" bilingualism. By definition, the balanced bilingual produces the same number of words in each language. The "unbalanced" bilingual, in contrast, communicates more predominantly in one language than the other (perhaps due to differences in competencies in each language).

2.2.1d Elite versus Folk bilingualism. Elite bilingualism (Paulston, 1975; 1979) is a consciously chosen and formally acquired speech of two languages. Despite this characteristic, it may for an individual involve a "natural" learning, e.g., the upper class children who may be brought up by foreign nannies and private tutors, foreign-educated parents, or having spent their formative years abroad, perhaps in a diplomatic mission. While the psychological aspects of this experience may have much in common with the situation of migrant children (who also learn

naturally from their surroundings) elite bilingualism is a privilege of wealth and power rather than an unavoidable social necessity. (After "natural acquisition" of a second language, further education in this second language may be improved through formal education.)

In contrast, the folk bilingualism exemplified by the experience of the new (low status) migrant is acquired out of the necessity of being able to communicate in one's everyday life. In most such cases, language learning is not formalized through education, and the grammatical rules, etc. are not formally articulated by the speakers. This type of bilingualism is commonly encountered among linguistic minority groups particularly those who are socioeconomically disadvantaged (Tosi, 1984). The most socially disadvantaged of these folk bilinguals may be incapable of functioning in a manner that allows them to meet the linguistic challenges of the middle class codes of linguistic expression. Consequently, their language inadequacies may result in their losing practical control of important issues in their lives (e.g., dealings with officials, etc.). As such, folk bilingualism will be, for many people, a liability in everyday life, as well as in the educational background of schoolchildren. (see Skutnabb-Kangas, 1976).

2.2.1e Bisemilingualism is a term developed by Scandinavian researchers to indicate retardation in both first and second languages (see Skutnabb-Kangas, 1976). For immigrant children, social segregation can cause linguistic performance (in both languages) to fall far below that which would be found for monoglots in either their country of origin or the host country.

Studies indicate that with bilingual immigrant children dual retardation in both their languages "may become a permanent feature leading to social stigmatization which may represent a lifelong handicap to their psychological, social, and moral development" (Beardsmore, 1982:10).

2.2.1f Additive versus Subtractive bilingualism is a distinction first introduced by Lambert (1974). Additive bilingualism describes a situation in which the learning of a second language cognitively enriches the individual without in any way suppressing his competence in his first language. Lambert was particularly concerned with describing the psychosocial characteristics of the milieus that permit competencies in two languages to develop in a parallel fashion without suppression. (The elite bilingualism described above might be thought of as one example of additive bilingualism.)

Subtractive bilingualism, in contrast, is described by Lambert as arising in situations where the second language is learned not by choice but through the coercion of circumstances that make second language a necessary precondition for survival -- a situation that characterizes the experience of many migrants. As a result of the fact that few people (and fewer authority figures) speak the migrant's native language, the "dominant" language (either for a given individual or, perhaps, across generations of a family) will gradually switch from Language 1 (native language) to Language 2 (dominant language) -- because that "new" language provides a medium for communication with a larger (and more powerful) audience. Thus the second language is learned at the expense of the first language.

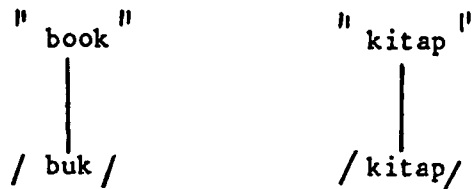
2.2.1g . Receptive versus productive bilingualism: Receptive bilingualism is a form of functional bilingualism in which competency in a second language (whether spoken or written) is (disproportionately) evident in the subjects ability to comprehend the second language without equivalent ability to produce (in writing or speech) the language. This receptive bilingualism obviously facilitates only one-way communications, e.g., the person may be able to read the newspaper or understand conversation around him but he must rely on his mother tongue to encode his own thoughts.

In contrast, productive bilingualism involves equivalent command of the passive and active roles in communication, i.e., the ability to understand others using the second language and the ability to express oneself in that language, not necessarily implying biliteracy or balanced proficiency in two languages. Pohl (1965:347) has formulated a parallel typology using the concepts of symmetrical (for productive) versus asymmetrical (for receptive) competence (see Beardsmore, 1982).

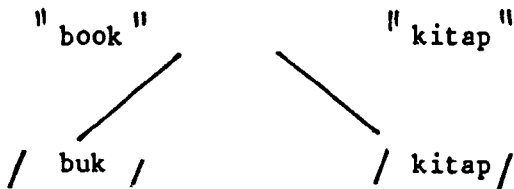
2.3 MODELS AND MECHANISMS OF BILINGUAL DEVELOPMENT

2.3.1 Coordinate and Compound Models. Studies of bilingualism often make fundamental distinctions between the typologies of bilingualism in order to study the relationship between languages in contact. A frequently used conceptual scheme was developed by Weinreich (1954) and revised by Ervin and Osgood (1954). This typology attempted to account for the relationship between the linguistic signs provided by languages and the symbolic or representational processes that were thought

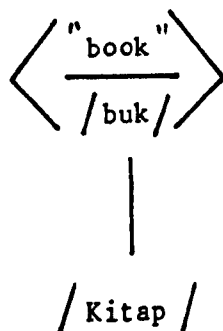
to underlie them. Essentially these typologies attempt to describe the ideational systems of bilinguals who, by definition, manipulate two sets of linguistic signs for the features of their world. Of the three typologies suggested, the first is usually termed the coordinate model. This model postulates that each set of linguistic signs (e.g., words) is associated with a separate set of meanings or representational processes which might be illustrated as follows:



A second model posits a single set of meanings or representational processes which are associated with expressions in both languages. This universal representational system underlying two (or more) languages is called the compound model of bilingualism. It may be illustrated as follows:



Here the single unit of content finds two forms of linguistic expression (one in each language). A third typology involves a single representational system which is derived from the native (first) language. Meanings in the subordinate (second) language are attached to the meaning system of the first language by translation. This typology which is called subordinate bilingualism can be illustrated as follows:



Cross-language interference is, according to the models, a particular concern in subordinate bilingualism since meaning results from a process of across-language translation (Paradis, 1977:238).

Evidence provided by Ervin and Osgood (1954) suggests that the linguistic behaviour of bilinguals varies between the proposed models depending upon the age at which the second language was acquired and the manner in which it was acquired. The compound models best fit those individuals who learned their second language alongside their first language or who learned it in the same environment as their first language (e.g., children raised in homes in which two languages were spoken). Research suggests that compound bilinguals associate a single representational system to their two languages and will use the languages interchangeably (where appropriate). (See, for example, Ervin and Osgood, 1954; Beardsmore, 1982.)

The coordinated bilingual model tends, in contrast, to best fit the linguistic behaviour of persons who learned their second language in an environment that was isolated from that of their first language learning (and in which there was little overlap in the languages spoken in different environments) -- as would be the case for migrant children who exclusively used a native language at home and a second language in school or for persons who were submerged in a second culture after early childhood.

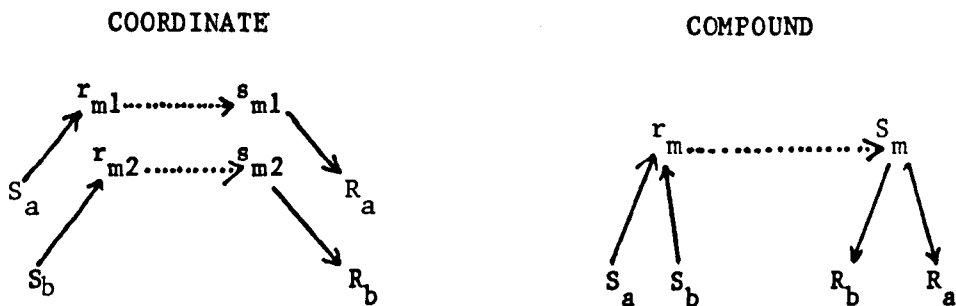
For the coordinated bilingual, the linguistic signs in each language are associated with a unique set of representational meanings. Each language's signs have their own uniquely

associated meaning. The separation in the process of acquisition of each language is thought to encourage this separation of ideational processes. Moreover, it is suggested that the nuances of connotative meaning captured by the ideational system of the coordinated bilingual mirror those of the native speakers of each language because the learning context imposed no external pressure to unify the ideational systems implied by the two languages. (This is so because the isolation of the languages in the speakers environment removes the need to switch codes within speech.) Connotative meaning is thought to be "the sum of all the functional semantic complexes which the child, to a great extent with the help of the environment and also as a consequence of his own experiences, has come to attach to the referential concrete meanings" (Skutnabb-Kangas, 198 :41).

The coordinated bilinguals are generally considered to be "true" bilinguals (Osgood, 1954) because the two languages are complemented by two independent meaning systems similar to that of monolingual native speakers of each language. Even though the coordinated bilinguals acquire their languages in separate environments, some cross-language interference may still occur due to the similarities in signs and meanings in human language. According to Ervin and Osgood, the more similar the signs and representational mediators in two languages, the greater the potential for cross-language interference for coordinated bilinguals. (This would predict greater interference between French and Spanish, for example, than between French and Chinese.) In contrast, delays in language production and blocking of responses in compound bilinguals tend to occur when

the responses required by the two languages are quite different. Errors in language production for compound bilinguals occur most frequently when the single meaning system must elicit quite different alternative responses in each language.

Ervin and Osgood (1954) have altered the threefold typology of coordinate, compound, and subordinate bilingualism originally proposed by Weinreich (see discussion by Skutnabb-Kangas, 1983, Ch. 5). In their model, where S stands for stimulus, R for response, r_m and s_m are "mediating Processes or meanings," and the subscripts 1 and 2 indicate the speaker's language. They describe the system graphically as follows:



They see subordinate bilingualism as a type of compound bilingualism. Skutnabb-Kangas (1983:101) has claimed that elimination of the "subordinate" model of bilingualism by Tripp and Osgood eliminated "the possibility of distinguishing between school bilinguals and natural bilinguals and between foreign language learning and second language learning." This issue of nuance is of importance to some contemporary researchers who argue that the initial three-fold classification was indirectly targeted on the cultural transmission that is crucial to discussions of cultural relativity and concept formation in

bilingual education (see Skutnabb-Kangas, 1983:103).

Lambert, Havelka, and Crosby (1958) and Jakobovitz (1962) have taken up these models and applied them in their research introducing other factors such as lexical, syntactic, phonological, cultural and attitudinal aspects besides the semantic functioning of bilinguals. Their results showed that compound bilinguals differed in the expected way from coordinated bilinguals only when the latter had learned their two languages in different cultural settings. Interestingly, there was no difference between compound bilinguals and those coordinated bilinguals who had learned their two languages in the same cultural setting -- as in the case of learning one language at home and the other outside the home or one language from a mother and another from a father.

This conclusion was strengthened by Jakobovits and Lambert (1961) who showed that a satiation task affected coordinated and compound bilinguals differently. (Satiation tasks involve repeating the same word over and over again; this decreases the connotative meaning given to the word on the semantic differential scale.) The results they obtained indicated that the compound bilinguals showed cross-language satiation, that is their semantic differential scale values were affected, whereas those of the coordinated bilingual were not.

However, other research has produced negative evidence. Olton (1960) found no difference between compound and coordinated bilinguals in his two studies. Moreover, Kolers (1963) and Lambert and Moore (1966) undertook some word studies of compound bilinguals and found considerable differences in the

associational networks of the two languages, differences that would not exist if the meaning systems of the two languages were identical.

These contradictory results led researchers to reassess their hypotheses, and the compound-coordinated distinction seems to have fallen into disfavour among linguists and psycholinguists. Not only was the evidence unclear, but even Weinreich himself recognized that all bilinguals are some mixture of these two types -- and they can shift their relative position between the two types with time. As Macnamara (1970) has observed:

The manner in which a person has learned his languages is unlikely to fix his semantic systems for life. Some may start with fused semantic systems but gradually sort them out; others may start out with separate systems but gradually permit them to merge (p. 30)

Diller (1970) and Paradis (1970) mention other problems with the distinction such as confounding of Weinreich's compound and subordinate types and the fact that Weinreich did not want to restrict the distinction to the semantic level. He felt it could apply to other levels, e.g., syntax, phonology. Lambert (1978) and Genesee (1978) have proposed replacing this distinction with the early versus late bilingual distinction.

2.3.2. Early versus Late bilingualism. A crucial and long recognized factor in second language learning is the age and manner in which the learning begins. Very early second language learning (e.g., during infancy and early childhood) is characterized by Swain (1972) as "bilingualism as a first language," which is to say that the young children effectively learn both languages as their "first" language. Adler (1977) calls such learning "ascribed bilingualism," and it might also be

called simultaneous bilingualism. In contrast, the bilingualism of late childhood (and adulthood) occurs after the first language is fully established, and it has been termed by Adler (1977) as "achieved bilingualism." It might also be called successive bilingualism to denote the fact that the acquisition of the two languages was not contemporaneous.

2.3.3 Simultaneous acquisition of two languages. McLaughlin (1978) makes a distinction between these two types of second language learning based on age, saying that those who learn their second language before age 3 are said to be simultaneous those who acquire their language after the age of 3 years are said to be sequential. Leopold's descriptions (1949a, 1949b) of his daughter, Hildegard, provided an early and careful linguistic description of simultaneous acquisition of two languages as well as a hint of the cognitive consequences that might result. Leopold's early descriptive work has been supplemented by many recent descriptive studies (see, for example, Vihman, 1980; Slobin, 1978). Volterra and Taeschner (1978) provide a particularly useful description of the stage at which the differentiation between the two languages occurs. They observed that the appearance of the first synonyms and subsequent decline of mixed-language word combinations to be the onset of such discrimination of bilinguals.

The situations in which a child will come to learn two languages simultaneously are quite varied. In early life the child may find himself exposed to two languages. For example, in the home situation, Vihman and McLaughlin (1982) notes that such exposure may occur because :

- a. parents or other members of the family use different languages;
- b. each member of the household uses both languages;
- c. the home may be basically monolingual, but the community may present the other language.

The world outside home may, in turn, present different language alternatives because, for example,

- a. the community may be predominantly monolingual in a single language thus not permitting the child to use his second language on a day to day basis;
- b. in the community outside the home the child may find monolinguals speaking two (or more) different languages (i.e., the community may consist mainly of monolinguals who speak either one or the other language).
- c. or both languages may be functional in the community permitting code-switching (i.e., the community may be largely bilingual);

2.3.4 Sequential acquisition of a second language. Not all bilinguals acquire their second language simultaneously. Most minorities acquire their first language at home or in the immediate community and their second language when they enter school. Some other children become bilingual when the family immigrates to a foreign country.

There exists a long standing myth that the earlier a language

is acquired the more fluent a person will be in it. As both McLaughlin (1978) and Genesee (1978) report, this myth is based on a number of questionable assumptions. One of these is linked to the notion of the critical period, as put forward by Lennenberg (1967) and others. This notion of a critical period holds that the brain is more plastic prior to puberty, and thus it is more open to language learning. In addition, it is claimed that the brain's hemispheric specialization for language is not achieved until about the time of puberty. Furthermore, younger children are thought to have fewer inhibitions and to be less embarrassed when they make mistakes.

All these supposed factors have been criticized in recent years (see, for example, Krashen, 1973, 1976, 1978; Seliger, 1978; Genesee, 1978; McLaughlin, 1978). It has been shown that young children are rather unsophisticated and immature learners in that they have not yet fully acquired many of the cognitive skills that could help them in second language learning (e.g., the capacity to abstract, generalize, infer, and classify). In addition, the notions of the critical period for hemispheric specialization (lateralization) has been questioned. Krashen (1973), for example, suggests that lateralization occurs at age four to five not at puberty. Seliger (1978), in turn, has proposed that there are different critical periods for different abilities and that this determines how completely one acquires different aspects of a second language.

2.4 BILINGUAL SPEECH CHARACTERISTICS: INTERFERENCE AND CODE SWITCHING

Looking at bilingual functioning we do witness different

mechanisms of speech when compared to monolingual speech. Among the observable characteristics of bilingual speech are interference and code switching which may appear at first thought to be the two sides of the same coin, but in fact they have different dynamics from the standpoint of the speakers. Deciding when the use of one language within the context of another ceases to be interference and represents a switch in language is a complex issue in need of close attention and may have important implications for bilingual cognitive functioning.

Interference is determined by intra-linguistic factors, whereas code-switching is determined by extra-linguistic factors: psycho-social, cultural residue being transmitted by second language contact. Formally, "interference refers to the use of formal elements of one code within the context of another, i.e., any morphological, phonological, lexical or syntactic element in a given language that could be explained by the effect of contact with another language" (Beardsmore, 1982:40). With low levels of biculturation the speaker will show considerable signs of interference on all levels of linguistic competence. Merely adjusting one's cultural habits is not adequate, but learning the appropriate linguistic habits to function within the target language group -- learning the language's beliefs, attitudes, values, and other behavioural patterns -- is what leads to competent bilingual behaviour. The general level of familiarity with the other culture determines the degree of sensitivity to linguistic rules. The more sophisticated and balanced bilinguals will use fewer transfers and borrowings and those who do use them would have an intentional basis for accentuating their discourse

to draw attention to the message conveyed.

2.4.1 Interference. In his book, Languages in Contact, Weinreich (1968) uses the term 'interference' to refer to any difference that may exist between the speech of a monolingual and that of a bilingual that may be a result of familiarity with more than one language. Haugen (1956) refers to it as "the overlapping of two languages". Mackey (1968) defines it as "the use of features belonging to one language while speaking or writing another." Clyne (1972) calls transference "the adoption of any elements or features from the other language." Fishman rejects the term altogether because it carries negative and disruptive connotations to the users.

Interference may be due to a lack of fluency in the language or getting in the way of the other language, despite the bilingual's attempts to keep the two languages separate. This may occur because:

- a. first, some bilinguals are more prone to deviations than others because of such factors as the manner of learning, mastery, use of language in the community, and,
- b. second, situational factors such as fatigue, stress, etc. may cause performance lapses.

Contrastive analysis (James, 1980) which was a popular way of studying the competence of a bilingual's second language performance takes the position that the first language of the speaker interferes with his second language acquisition. The contrastive analysis hypothesis was based on the assumption that where structures of the first language differed from those in the second language, errors based on the structure of the first

language would be produced, due to the automatic and subconscious linguistic habits of the speaker in the new learning situation, resulting in positive and negative types of transfer (Krashen et al., 1982). The contrastive analysis hypothesis has been a weak predictor of bilingual learning performance. So far, contrastive analysis has been applied to bilingual performance to refer to two very distinct linguistic phenomena, one being basically psychological and the other basically sociolinguistic.

Psychological use of the term interference refers to the influence of old habits when the new ones are being learned. The sociological use of interference refers to language interactions such as linguistic borrowing and language switching, that occur when the two languages are in contact (Krashen et al., 1982).

Lambert argues that this distinction had not been made clear within the contrastive analysis literature and the data documenting these sociolinguistic phenomena, gathered by Weinreich and Haugen, were merely classified as empirical support for the psychological phenomenon of negative transfer -- first language habits impinging on the acquisition of the second language (see, Lado, 1957, p. i).

Interference tends to be at the unconscious level where the speaker is not aware or cannot help the fact that he is producing foreign language elements. Code-switching, on the other hand, is a purposeful act between bilingual speakers who would acknowledge its meaning in communication. The fact that interference and code switching are triggered by different mechanisms is manifested by the difference in the bilingual's speech to a monolingual versus to a bilingual (fluent in the same pair of

languages).

When analysing bilingual performance it is useful to consider two perspectives in evaluating the limitations as well as the cognitive richness of bilingual performance. The first perspective is that of a bilingual speaking to a monolingual in a monolingual environment, and the second is the perspective of a bilingual speaking to another bilingual in a bilingual environment. The first situation would permit us to label any deviation of bilingual speech from the monolingual norm as interference due to the linguistic limitations and confusions of the bilingual speaker. The second situation, in contrast, would allow for an altogether different phenomenon known as deliberate code switching (that is deliberate language mixing).

Unfortunately some researchers have used the term interference to describe such conscious language switching and borrowing that takes place among bilinguals within bilingual environments. In a bilingual environment code-switching provides a new language variety with complex grammatical constraints governing its use and form (see Oksaar, 1983).

The language behaviour of bilinguals speaking to other bilinguals is of much greater interest to us since we are concerned with the nature of bilingual thought processes rather than linguistic analysis.

2.4.2 Code-switching. Speech patterns of bilingual speakers are determined by a complex set of factors (linguistic, psychological, societal) some of which may lead to interference and some may be conscious strategies used for stylistic purposes

(Rayfield, 1970: 54). Having made this differentiation, we could commence discussing code-switching from a linguistic, cultural, and cognitive point of view.

Poplack (1979) as a result of his studies of Puerto Rican bilinguals writes: "code switching is a verbal skill requiring a large degree of competence in more than one language, rather than a defect arising from insufficient knowledge of one or the other" (p. 72). Code-switching is most often engaged in by those bilingual speakers who are the most proficient in both their languages. In recent years linguists have started to recognize that code-switching is linguistically constrained obeying rather strict structural rules in addition to the grammatical rules of each of the component languages. It is not a haphazard mix and match, where a word or series of words from the other language is brought into the dominant language. Code alternations within a single sentence involve the insertion of a word or a short phrase referring to a single, unified notion; or entire phrases or clauses with a complex grammatical structure.

As described in Dulay, Burt, and Krashen (1982), "The languages may shift back and forth several times within a single sentence. Within each stretch of speech the grammatical structure belongs completely to the particular language being used. That is to say, the word order, morphology, syntactic processes, etc. are all those of the language of the particular stretch of speech. Furthermore, the phonetic and phonological structure of a given unilingual segment is systematic and conforms to the structure of the language. At the point of alternation the entire structure -- syntactic, morphological,

phonological -- shifts to that of the other language. Each unilingual segment thus retains an internal structural consistency that shows all of the complex grammatical and phonological characteristics of monolingual speech." Lipski (1978; quoted in Grosjean, 1982) states that the totality of two-language performance is more integral than two separate grammars and linguistic systems in the following words:

. . . it is clear that, despite superficial appearances of random and unprincipled behaviour, bilingual code-switching does seem to obey a rather stringent set of sentential constraints. These constraints are of two fundamental types, intralinguistic and interlinguistic (p. 274).

Apart from sticking to the internal linguistic structures of each of the languages, code alteration is a controlled process occurring only at specific, definable syntactic junctures, such as relative clause boundaries, before adverbial clauses, at the beginning of verb phrases. Alternation may also take place as noun qualifiers, verb complements, parts of a noun phrase, or the predicate portion of an equational sentence (Gumperz and Hernandez-Chavez, 1971). Alternations that are made at unpermitted places in a sentence are considered ungrammatical by persons proficient in code switching (Aguirre, 1975; see Grosjean, 1982).

From a sociolinguistic point of view, code-switching serves a number of specific functions. Cook-Gumperz and Gumperz (1976) have pointed to the following situations where such functions are operational:

- a. among bilinguals, to symbolize ethnic identity, or the intra-ethnic character of the interaction;
- b. to permit the precise expression of ethnically or

culturally relevant information (to express certain nuances of meaning that are not available to the speaker in that language);

c. the act of code-switching itself may be for a stylistic effect, e.g., to raise status, add authority, show expertise;

d. transmitting a sense of personal feeling, degree of intimacy, or conveying confidentiality, etc.

In relation to a monolingual speech these kinds of effects can be compared to the changes in intonation, loudness, rate of speech, vocabulary choice, etc., that occur in stylistic switching within a single language (Cook-Gumperz and Gumperz, 1976) when we compare monolingual and bilingual speakers we may find similar mechanisms that operate in their performances. For example, an unsophisticated monolingual trying to adjust his speech in a formal conversation with a highly sophisticated monolingual speaker may run into interference in spite of a conscious attempt to code-switch in style. His dialect may fail him, he might use terms and grammar that does not measure up to standard language. (This failure may mirror the interference phenomenon among bilinguals.) Code-switching would be the colloquial use of the same language, using appropriate, socioculturally relevant terms, taking into consideration the age, social status, topic of conversation, degree of intimacy, situation of the interlocutor within a monolingual environment.

A competent bilingual speaking to another bilingual sharing his language may deliberately use different cognitive strategies in his languages. Bilingual code-switching may be utilized to

the extent there is an equality in the personal repertoires of the speakers, shared cultural characteristics, a degree of intimacy and friendship, etc. Under such conditions, the bilingual may choose intentionally to code-switch for a more colorful and expressive conversation.

These may seem to be deviations or evidence of interference to a monoglot speaker. Lambert and Moore (1966) have shown that "the associations attached to terms used by bilinguals do not necessarily coincide with those of monoglot speakers, in that part of the associations of the cognate words in each language are present in some bilinguals words" (Beardsmore, 1982:41). This may be due to the linguistic contact between two semantic systems. This semantic interference, if not shared by the two parties in the conversation, may lead to misunderstandings or confusion even though uttered in perfect clarity. (This might be said to represent interference at the connotative level of meaning.)

Choice of a language depends on the content of the conversation. Bilinguals usually explain that the reason they code-switch is that they lack facility in one language when talking about a particular topic. They report that they code switch when they cannot find an appropriate word or expression or when the language being used does not have the items or appropriate translations for the specialized terms needed. They also typically report that some notions which may cause embarrassment are just better expressed in one language than the other, e.g., sexual and birth control practices. The phenomenon of "the most available word" is also extremely frequent in

bilingual speech and occurs, according to many bilinguals, when they feel tired, lazy or angry (Fishman, 1965).

Although many instances of code-switching can be explained by the lack of appropriate terminology in one language, the "most available word" phenomenon, habit, or triggering, in many others instances it involves particular verbal or communicative strategies. Gumperz (1970, 1976a, 1976b) and Gumperz and Hernandez-Chavez (1978) have stressed that switching at a particular moment conveys semantically significant information. According to these authors, code-switching is a communicative resource that builds on the participants' perception of two contrasting languages. In this case, code-switching is meaningful in much the same way that lexical choice is meaningful. Gal(1979) reinforces this view stating that "listeners interpret code-switching as an indication of the speaker's momentary attitudes, communicative intents, and emotions."

The Whorfian hypothesis claims that different linguistic communities observe reality in terms of categories which are specific to that culture and transmitted by that language, i.e. the more imposing realities producing different numbers of terms to describe and express the states and happenings surrounding the people. Languages spoken in certain cultures can thus be associated with a different type of values. Interesting contrasts are discovered in the kinds of associations linked with the two languages, and the ways in which the bilingual's attitudes may be influenced by the language he is using (see study of American-Japanese women by Ervin-Tripp, 1968).

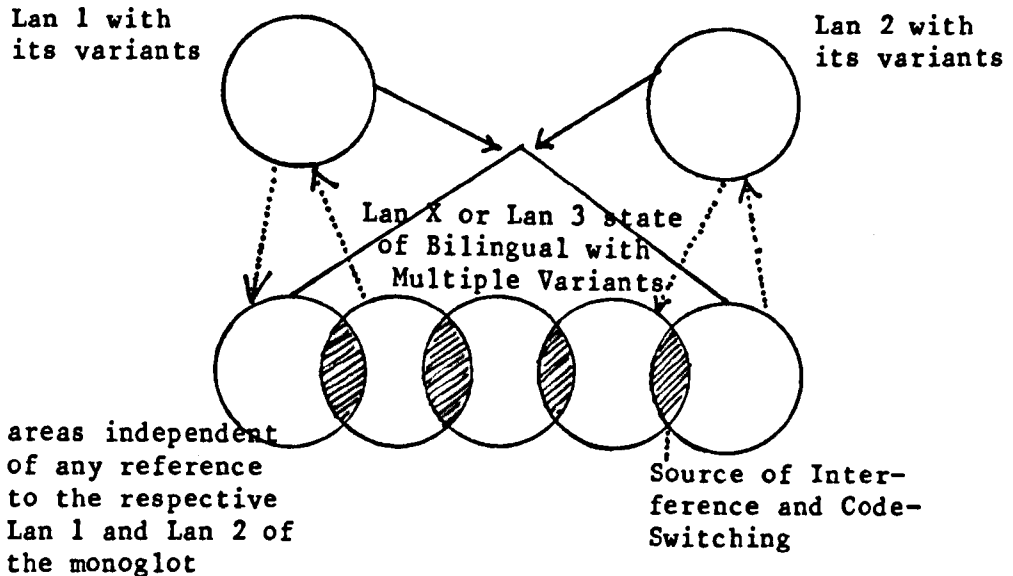
The choice of language may influence the state of mind and the type of personality which one projects. In a study of Moroccan French-Arabic bilinguals, Bentahila (1983) concluded that this flexible nature of language reflects the way a language as part of a culture may be closely linked with other aspects of that culture. This finding showed that the language preference of the speakers come to be associated with certain values, concepts, and feelings and are not interchangeable across languages. The results indicated that French is used among Moroccan bilinguals when there is a need for refinement, social distance, formality or technicality. Arabic is preferred in an atmosphere of intimacy, simplicity, or domesticity.

Compared to a monoglot, the bilingual has a wider and richer repertoire at his disposal than a monolingual and monocultural person. The degree of acculturation and bilingualism is what determines the flexibility, richness and control that a bilingual speaker may have in manipulating code-switching strategies in his speech. Even though a bilingual may not optimally be as competent as a monolingual, he has a different spectrum where the interaction of his two languages may give way to different features in his thinking and linguistic performance, i.e., interference, code-switching, semantic contact.

Oksaar (1979, 1983) pointed out that the analysis of bilingual behaviour has shown that the bilingual not only uses the elements from Language 1 and Language 2 in his speech but also has developed a Language X or Language 3 standing for a unified repertoire made up of elements of Language 1 and Language 2 which in their totality equate with the complete repertoire of

Language 1 speaker, although they do not necessarily coincide with it.

The diagram below shows the complexity that the two languages constitute in bilinguals:



Lan X, according to Oksaar (1983, p. 23), has its own norms of usage, linguistically and socially; they are directly connected with the phenomenon of code-switching which he liberally defines as, "the alternating use of two languages without any interferences as well as their alternation with several types of interferences." Von Gleich's (1982) study provides some empirical evidence for adoption of Lan X model for the explanation of the choice between Quetchua and Spanish according to different situations.

2.4.3 Code-switching in children. The alternate use of two languages in conversation begins early in bilingual children.

This behaviour is quite different from adult code-switching in many ways and recent research has isolated some of these differences. McClure (1977), for example, notes that the Mexican-American children she observed produced different kinds of code-switching depending on their age. Single items inserted from one language into the other were used more by young bilinguals. Bilingual children over the age of nine code-switched for at least a phrase or a sentence. McClure analysed the nature of code-switching and how these developed over time. She found that switches were used to resolve ambiguities or to clarify statements by children as young as three years old. Another reason for code-switching at an early age, is to attract or retain attention. These switches would be comparable to raising the voice, touching the person, or making eye contact. At about age six, McClure found instances of switches that were related to mode shift: shifting from narration to commentary or from soliloquy to questioning. At a later age of eight or nine alternation of languages was used for emphasis as in cases of giving commands. Among the late developed switches were those of elaboration of speech and content. (See, Grosjean's (1982) work entitled Life with two languages.)

Code-switching also serves a function as language play among children. Just as monolingual children play with language by making words rhyme, inventing new words' or using certain words in inappropriate contexts, so do the bilingual children play with two languages. Children often amuse themselves by mixing languages, making a word from one language and giving it a case ending of the other, separating words into syllables and finding

meanings of the other language in segments of words. Indeed, I often found my own daughter who has alternated between English and Turkish manipulating words according to their sounds and meanings in two languages, making sense out of absurdities or at times distorting sensible utterances.

2.5 INTERVENING VARIABLES RELEVANT TO COGNITIVE DEVELOPMENT THAT VARY ACROSS BILINGUAL POPULATIONS

The consequences of becoming bilingual and/or bicultural has been an important issue for educationalist in the West at least since the early 1900's (see Weisberger, 1935; Saer, 1923; Pintner, 1932; Darcy, 1946, 1953; Lewinson, 1959). It is important to keep a historical-comparative perspective in evaluating the research so far done in trying to understand the phenomenon of bilingualism. Most of the early studies derived from the American immigrant experience and emphasized the negative effects of bilingualism on intelligence (see, for example, Pintner and Arsenian, 1937; Spoerl, 1944; Hill, 1936). A few of these studies found no significant differences between the IQ test scores of monolinguals and bilinguals. Only two of the early studies (Davies and Hughes, 1927; Stark, 1940) suggest a positive effect of bilingualism on cognitive development (see review by Lambert and Peal, 1962). However, when this body of early research has been critically reviewed, shortcomings of methodology, sampling, testing materials, etc. together with failures to control for relevant variables (e.g. socioeconomic status and language proficiency in the language in which testing was performed) have been found.

More recent research on the effects of bilingualism on

cognitive development has produced more mixed results. A distinguishing aspect of this more recent research has been its greater attention to the need to control for variables relevant to IQ that may vary across samples of bilinguals and monolinguals, e.g., language competence, socioeconomic status, cultural milieu, etc. together with factors such as adequacy of test standardization, age and context in which children acquired their second language, etc. The results of more recent research suggest that bilinguals may, in some respects, experience cognitive advantages as a result of their bilingualism. The most common findings are stated in terms of cognitive or intellectual "flexibility," with bilinguals appearing more "flexible." One of the earliest of these positive results was reported by Leopold (1961:358) who concluded from detailed observations of his daughter's bilingual development that there appeared to be "a noticeable looseness of the link between the phonetic word and its meaning."

The most positive turn in the findings in this area came with the work of the Canadian bilingualism projects which reflected the growing accommodations in the 1960s to the needs of French-speaking Canadians. The earliest of this Canadian research suggested positive cognitive effects of bilingualism (Peal and Lambert, 1962) -- followed by other research that showed mixed results (see Balkan, 1970; Ianco-Worrall, 1972; Ben-Zeev, 1972; Cummins and Gulutsan, 1974). The more recent studies reporting positive effects of bilingualism on cognitive development have tended to employ rather different measures. In theory, one would like to have not only identical tests but identical populations

of children who were randomly assigned to become bilingual or not. Random assignment, however, is almost never possible. As a result, researchers have tried to match personal and background characteristics of monolinguals and bilinguals -- so as to produce groups that might have equivalent expectations for their cognitive development (except for any effects of bilingualism). Common control variables have included sex, age and socioeconomic status. Measures of (nonverbal) IQ prior to second language acquisition have also been an important feature of some research programmes (e.g., Peal and Lambert, 1962). Matching on such cognitive variables (IQ, etc.) doubtlessly has the effect of increasing the homogeneity of the groups on other variables (such as socioeconomic status).

2.5.1 Socioeconomic Status and Cultural Environment. The role of socioeconomic status has generally only been studied from the 1960's onwards. James (1958) and Jones and his collaborators (1960), for example drew attention to such factors (see review by Darcy, 1953). Paulston (1975) has noted that the socioeconomic status of students is a dominant factor in distinguishing successful and unsuccessful bilingual education programs.

Early studies involved economically disadvantaged minority groups who were at a disadvantage in terms of their linguistic competence. Some recent studies have, however, used balanced bilinguals from more privileged socioeconomic backgrounds (for example, studies conducted in Switzerland and Canada).

The nature and purpose of bilingualism in lower and upper social classes are different. The bilingualism encountered in

the upper classes is often a matter of choice, style of living, and a "positively valued" cultural experience. When one looks at the populations of the Middle East one notes that bilingualism (and, indeed, tri- and multilingualism) is common among the upper and middle classes. The social and psychological background of these people is strikingly different from that of the groups who migrate from the Middle East to become bilingual minorities in the West. The Middle Eastern bilinguals often need to establish international contacts, to communicate and compete in the international arena, and they often have a history of bilingualism which may extend for several generations and be a part of academic curricula. (One notes, for example, the existence of French, English, German, and American private schools in many Middle Eastern nations which offer their instruction to the children of the elite in a second language.) Indeed, it does seem that there is still a "natural" bilingualism among the elites in nations such as those of the Middle East and North Africa where the traditional "languages of imperialism" (English, French) are still used as a common language of communication for high status activities. This situation contrasts sharply with that of the Middle Eastern migrants to the West. These migrants to the West come to highly differentiated societies where the odds of their competing with (let alone surpassing) the natives is small. These migrants were disadvantaged in their own cultures and now are doubly disadvantaged in their new homes, but they seek, nonetheless, a material increase (and, perhaps, a way around the impediments to success in their country of origin). As a result of their

migration they find themselves in a foreign culture with its social and economic demands. In the initial period, the immigrant group may rely on its own language and culture for survival in the new home. Overidentification with the native culture and the "crowding together" of the migrants may result in negative stereotyping and discrimination against the migrants in the host culture. Prejudices may form that are detrimental to the cognitive, emotional, linguistic and scholastic development of the children of the immigrants. And, as a result of the cultural and cognitive paralysis that affects migrants, they may be unable to cross over the barrier from inferior status to equal status with the native population. They thus may come to form an "underclass" in their new home nation.

2.5.2 Language Proficiency and Cognitive Development. When one looks at descriptions of the underclass in the West, one can not help but note the roles played by minority status and linguistic (in)competence in the dominant language, as well as in the native language in accounting for differences in cognitive and academic performance. Cummins (1978; cited in Paulston, 1980) at a symposium at the International Association of Applied Linguistics, posed the following multivariate question about the different cognitive consequences of bilingualism in the upper and lower classes:

Why does a home-school language switch result in high levels of functional bilingualism and academic achievement in middle class majority language children, yet lead to inadequate command of both first and second languages and poor academic achievement in many minority children?

As we have seen from our previous discussion, social class and cultural environment play an important role in preparing the child to attain different types and degrees of bilingualism. As a consequence of the sociocultural environment, the societal and individual demands imposed upon the child's linguistic competence determines his level of cognitive functioning in the society. And thus, the levels of proficiency the bilinguals attain in their two languages may determine the effects of bilingualism, per se, on their cognitive development. Before going into any specifics of linguistic competence, we should note the distinction that Gaarder makes about bilinguals; that is between, elite and folk bilinguals (1977).

As we have mentioned elsewhere elite bilingualism has been a cognitive asset throughout history in all parts of the world. Our concern here would be that folk bilingualism stems from very different sources than elite bilingualism and poses a problem for child's scholastic achievement. This would suggest that the formation and function of folk bilingualism may account for the negative effects of bilingualism on cognitive development.

2.5.2a Literacy in Mother Tongue. Those researchers who are interested in the state of minority languages in the communities and their use in schools (e.g. Albin and Ronell, 1972; Tosi, 1979) indicate that

On a social level, where one generation's language provides the limited data for the succeeding generation's grammar building process, progressive changes in norms and meaning lead inevitably to the extinction of a minority language when it is not developed by formal education. At an individual level, inconsistent models in the family, lack of reinforcement of accepted norms and exclusion from exposure to the standard language in the community are responsible for weakening children's language development (Tosi, 1984).

Research has shown that failure in first language development often results in unsatisfactory development in the second language (Skutnabb-Kangas, 1976) which results in double semilingualism, a concept introduced by Ringborn (1962) and later used by Hansegard (1982) who defined it as "functioning in two languages without really being proficient in either." Loman (1974) explains semilingualism as a term used for the type of faulty linguistic competence which has been observed in individuals, who since childhood had contact with two languages without sufficient training and stimulation in either of the two languages" (Paulston, 1975). A series of Swedish studies indicate a positive correlation between competence in Language 1 and Language 2 and school performance. They also consistently support the hypothesis that instruction and literacy in Language 1 can make up for the negative effects of semilingualism (Malmberg, 1971, Skutnabb-Kangas, 1976). The effects of semilingualism are especially detrimental at an early age when the child has not been exposed to a fully developed language (Taukomaa, 1972). Hyes (1974) has summarized this situation as "giving up one language before they learn a second," which results in a limited vocabulary, a crippled grammar, and inability to elaborate complex abstract thoughts in either language.

It may be a consequence of this "fact of life" for the migrant group that accounts for the fact that their bilingualism may not be an advantage for abstract thought. In fact, it might be argued that the common folk bilingualism constrains cognitive

functioning. In this case the metaphor of a "bilingual straitjacket" might be more appropriate than viewing bilingualism as an intellectual asset.

In discussing these issues Lambert (1975) introduced the concepts of additive and subtractive bilingualism; his distinction emphasizes the degree of prestige and social relevance of the two languages in question. In situations where the child's first language is dominant and prestigious, e.g., the acquisition of (prestigious) English by a French school child, would not result in the replacement of the child's first language, but rather the supplementation of his first (native) language. In such cases we are talking about what might be called additive bilingualism. However, in situations where a child functionally replaces his first language with a second (usually more prestigious) language, we would call it a case of subtractive bilingualism. This does not usually facilitate any further challenges to the child's competence at expression in his first language. Consequently, the child's first language ceases to be a cognitive asset; his pre-existing tools for organizing, structuring, and mediating are no longer functional.

2.5.3 Threshold level hypothesis. The levels of proficiency the bilinguals attain in their two languages may play an important role in determining the effects of bilingualism on their cognitive development. In order to bring about the positive effects of bilingualism Cummins (1978) claims that children should have attained a minimum or threshold level of proficiency in their two languages to be able to transfer their

communication skills and thought for effective performance.

Prolonged difficulties in two languages that operate over a long period of time will naturally put a strain on the child's interaction with his environment both in terms of input and output in developing a higher order cognitive network. Thus his innate intelligence will find limited expression and the child will experience confusion, frustration, and finally resignation to his limited linguistic medium (Cummins, 1984).

What we should bear in mind is that this threshold level of bilingual competence is not a causal but an intervening variable in bringing about the positive cognitive effects. The threshold level of competence does itself depend on the social, attitudinal, economic, educational, cognitive factors operating on the child. The favorable conditions for a high level of competence would be learning of a socially relevant language, a bilingual environment, and having highly motivated parents and teachers. Under these conditions the two languages would come to complement each other, each fulfilling a different role and being viewed as equally valuable. Cummins (1984) assumes that when a child attains the minimum level of competence in his two languages, his cognitive functioning is positively affected either by

- a. the fact that the child has two linguistic media to deal with his environment;

and/or

- b. as a consequence of his bilingual learning experiences (being exposed to different people, values, beliefs, etc.) the child may be exposed to a wider range of sociocultural experience.

The conditions of the linguistic environment and the demands made on the child coupled with his motivation will eventually determine the level of language proficiency attained by the child (Cummins, 1984:107). In considering the interaction of bilingualism and cognitive development we may find it useful to differentiate between two threshold levels of language attainment in children that might bring about different consequences in their cognitive performance. Cummins (1979, 1980) distinguishes between lower and higher levels of competence. The former may be adequate for the demands made of a younger child (younger than 6), the latter level may be necessary to deal with more complicated operations, and abstract thoughts where language in itself becomes an instrument through which the child can operate on his environment -- through verbal communication which reflects his level of intelligence and consequently benefits from cognitive growth. In contrast, the older child (pre-operational and concrete operational) is constructing his world through acting upon his environment and can accommodate the new language as the need arises. Cummins describes these states as follows:

1. Lower level of competence (BISC: basic interpersonal social communicative skills) is the medium of communication of everyday life. It is cognitively less demanding and more concrete. Contextual cues in the environment can serve to organize thoughts. This type of proficiency involves mastery of accent, oral fluency, basic vocabulary and basic syntax. This is the surface fluency that might be described as the child being cognitively in control of his language.

2. Higher level of competence (CALP- cognitive-academic language proficiency). At this level the second language becomes an instrument of thought to manipulate abstract dealings within the intellectual realm. This level of competence is the crucial factor in bringing about positive cognitive changes in the child's development. It is correlated with verbal parts of IQ tests and tests of vocabulary, synonyms and analogies, as well as syntactic maturity.

2.6 EMPIRICAL EVIDENCE ON EFFECTS OF BILINGUALISM

2.6.1 Neurolinguistic Evidence. As noted in the Chapter 1 (Introduction) there has been a recent series of studies that have suggested that patterns of cerebral organization may vary between monolinguals and bilinguals. This research is an outgrowth of the cerebral lateralization studies which have over the last two decades provided impressive evidence that the two cerebral hemispheres have rather different functions; and that the nature of this asymmetry of function varies for persons who are not right-hand dominant and apparently between the sexes (see review by Krashen, 1976).

The original discoveries in this area followed from research on persons with brain damage to only one cerebral hemisphere through stroke or accidents (e.g., Lennenberg, 1967) and subsequently from the so-called split-brain research begun by Sperry and his colleagues in which the cortical commissures joining the two hemispheres are surgically severed. (This procedure is used in the medical treatment of patients with

extreme cases of epilepsy; it is supposed to prevent the spread of epileptic seizures to the other hemisphere.) Dichotic listening experiments (e.g., Milner, Taylor, and Sperry, 1968) studied the processing of verbal stimuli presented to the left, right, and then both ears of the split-brain patients. These experiments provided evidence that verbal cues were dealt with by the left hemisphere. In normal subjects, response to stimuli presented to the left ear (and thus the right hemisphere) is typically only slightly below that found with stimuli presented to the right ear (and thus the left hemisphere). However, in the split-brain subjects whose pathways between the two hemispheres had been severed, the same experiment produced huge differences between the results for the left and right hemispheres. These differences were taken as strong evidence for the dominance of the left hemisphere in language processing. Besides the work by Sperry and others on split-brain patients, and the studies of persons with localized brain damage, there have been studies of patients who have had one hemisphere surgically removed. These studies (e.g., Berlin et al., 1972; as cited in Krashen, 1976) produced very similar results in support of the notion of the dominance of the left hemisphere. Indeed, they also are consistent with the clinical finding that removal or anesthetization of the left hemisphere almost invariably produces aphasia, while similar treatment of the right hemisphere seldom produces this result.

During the 1970's there began to appear some studies which tested populations of normal monolinguals and bilinguals in an attempt to determine whether left hemisphere dominance in

language functions were the same for bilinguals and monolinguals -- and also to test whether this dominance was equivalent for both of the bilinguals languages. Galloway and Krashen (1980) has presented clinical evidence suggesting that some variation in hemispheric lateralization may occur in bilinguals. They found a higher incidence of right hemisphere lesions among bilinguals with aphasia: 15 percent of bilinguals had right hemisphere lesions versus only 2 percent of monolinguals. Galloway took this as a suggestion that the right hemisphere may play a stronger role in the language processing of bilinguals. Genesee et al. (1978) have presented evidence from a dichotic viewing task and found greater evidence of neural activity in the right hemisphere among persons who became bilingual at a late age (after 12), but not among early bilinguals (whose EEG readings were similar to those of monolinguals). The evidence, however, on this point is mixed. Soares and Grosjean (1981), for example, found no differences between bilinguals and monolinguals on a replication of the Genesee experiment when the sex and handedness of the respondents were controlled. The most recent review of this literature (Springer and Deutsch, 1985:203) concludes that:

The nature of the relationship between hemispheric asymmetry and bilingualism is clearly complex. As a result, the controversy surrounding this issue is likely to continue until reasons for the variation from study to study are identified and explained.

2.6.2 Cognitive Consequences of Simultaneous versus Successive Bilingualism. Comparing the children learning a second language simultaneously or sequentially, we might say that the child who learns a second language after the first has

been established has a cognitive advantage over the other one, and also over the monolingual child who does not have that kind of experience. Second language learning brings about a consciousness of what it is to mean, and how intentions are realized in a language (Vihman and McLaughlin, 1982). Felix (1978) in his research with English-speaking children learning German as a second a language did not find the children to pass through a presyntactic stage of development during which utterances are constructed on the basis of semantic relations (Vihman and McLaughlin, 1982).

Seliger(1980) has proposed a distinction between "strategy" and "tactic" to explain how it is that the second language learners take different routes to gaining proficiency in the target language. Seliger assumes that strategies, being a superordinate, abstract, constant, and long-term process are used in all language-learning situations. Examples are overgeneralisation, simplification, and hypothesis testing. What learners do to meet the immediate demands of a particular learning task or situation is called a tactic. There are particular problem-solving devices used by individual learners with varying degrees of success. For example, use of formal rules may be a characteristic tactic of second language learners who have approached the language primarily through error correction and rule isolation in the classroom. Tactics of this sort are not employed by preschool children as a deliberate act.

In the case of successive second language learning, the child is more mature cognitively and has accumulated experience with a linguistic system. Hence the child tends to make greater use of

formulatic expressions in the beginning.

Ben Zeev notes³ that once the child grasps a number of basic structural rules he has begun to understand that he has two different language systems. Only after this differentiation takes place can we talk about interference mechanisms in his speech (which may reflect the strategies he employs in rule application). Ben Zeev has hypothesized that bilinguals run into interference as a result of their attempts to keep their two languages separate by means of maximizing the structural differences between the languages leading to overgeneralizations, and neutralizing, that is, by simplifying structure within one of the languages. These strategies may facilitate the incorporation of the structures in general into the child's cognitive system but may also have shortcomings. Ben Zeev (1977, p. 45) summarizes the process as follows:

Perhaps bilingual children are more ready to extend the application of a rule to its various contexts than are other children because of the need to see each of his languages as consistent. The consequences of this readiness to generalize are not all positive. The bilinguals might grasp general rules and extend them more quickly, but by the same token they may be slower in attending to the increasingly detailed modifications of rules within the language as they conflict with other rules of that language.

2.6.3 Metalinguistic Awareness. In recent years metalinguistic awareness has drawn a lot of attention. Developmentally, the child becomes more aware of the world outside and at the same time more aware of the psycholinguistic processes going on in himself. The use of language with an intent and direction develops gradually. Clark (1978) distinguishes among various types of linguistic awareness.

- a. monitoring one's own ongoing utterances;
- b. checking the results of one's utterance to see if the listener has understood;
- c. testing out new words and verbal styles;
- d. reflecting on language structure independent of its actual use.

Sinclair (1978) notes from her research that the first clear instances of awareness are the reflections on what things are called (words), followed by relational meanings leading to grammar which formally links meaning to external form in the same manner as logico-mathematical operations go beyond the concreteness of physical events. Once the grammar is grasped and analyzed the child is able to construct sentences beyond the immediacy of the spoken domain. At the same time this development leads to a deeper understanding of the underlying structure of spoken speech. In short Sinclair (1978) interprets the phenomenon of "becoming aware" as the how and eventually the why of specific actions and interactions.

This argument parallels one made by Vygotsky (1962). He notes that there is an analogy between concept learning and second language learning. He describes the advantages of second language learning as follows:

In one's native language, the primitive aspects of speech are acquired before the more complex ones. The latter presupposes some awareness of phonetic, grammatical and syntactic forms A foreign language facilitates mastering the higher forms of the native language. The child learns to see his language as one particular system among many, to view its phenomena under more general categories, and this leads to awareness of his linguistic operations. (Vygotsky, 1962, p. 109)

The evidence of metalinguistic awareness comes with the beginnings of code-switching among bilingual children. As researchers have reported with their young children, e.g., little Vihman commenting in Estonian on what she had just said in English: "I said goodbye to the lady." At the age of 2 years and 2 months she began to adjust her choice of language to her interlocutors (Vihman, 1980). Slobin (1979) notes similar language behaviour in his daughter who learned Turkish as a second language. At the age of 3 she asked questions about speech and language and was struck by the arbitrariness of language.

Feldman and Shen (1971) found that bilingual Head Start children were superior to monolingual children in their ability to switch names and to use common names and nonsense names in relational statements. This research seems to support Vygotsky's (1962) position that exposure to a second language helps children to see their language as only one particular system among many possible systems. It thereby increases metalinguistic awareness.

The child acquiring two languages simultaneously goes through much the same experience as the monolingual child, with the additional task of sorting out the two languages. This complication can lead to delay in various aspects of linguistic development. In addition, it often leads to the use of mixed language utterances and interference between the two linguistic systems, as we have discussed, at least in the initial stages. What follows is a gradual process of language differentiation, affecting different parts of the child's linguistic system at somewhat different times.

2.6.4 Cognitive Flexibility. While the pioneering work of Peal and Lambert has had only mixed success in demonstrating an advantage of cognitive flexibility for bilinguals, there are other studies which complement the "positive" finding of the 1962 research. The idea of cognitive flexibility for bilinguals traces (at least) back to Leopold (1949) who examined the bilingual (German-English) development of his young daughter. In particular, Leopold observed that she would freely alter wordings of rhymes and songs substituting semantically equivalent wordings. He characterized this as a benefit since it broke down the primitive identification of objects and concepts with the words that signified them.

Having two words for the same referent not only directs the child's attention to the conceptual attributes of objects in the external world, but also focuses his attention on his linguistic operations themselves. This can lead the child to contrast and compare his two languages and can account for the superior performance on measures of verbal intelligence (Leopold, 1949; summarized by Cummins and Gulutsan, 1974, p. 135)

Evidence on a more systematic scale of such effects has been produced by several investigators during the 1970's. Ianco-Worrall (1972) conducted research with Afrikaans-English bilinguals and matched samples of monolingual Afrikaans and English monolingual children (aged four to nine). Two of her tests produced evidence in support of a notion of cognitive flexibility of bilinguals. In the first test (derived from Vygotsky, 1962: 44) children were merely asked to express a preference for pairs of words (selected from three words). The words were selected so that they were similar in either their

sound or their meaning, e.g., the group: cap, can, hat.

Children's selections of two words were scored as showing a preference for phonetic similarity (e.g., cap and cat) versus semantic similarity (e.g., cap and hat). Ianco-Worrall found that young bilingual children were much more likely to group pairs by similarity of meaning than young monolingual children. Among older (7 to 9) children, the difference was slight, with both groups preferring groupings by meaning to those by sound.

In a second, rather more interesting demonstration, she asked children if the names of objects could be interchanged (e.g., suppose you could make up names for things, could you call a dog "cow" and a cow "dog"?). She then had the children play a game in which they were to change the names of objects and then answer questions about the renamed object. (For example, let us call a dog "cow." Does this "cow" have horns? give milk? etc.). Ianco-Worrall found that when asked about the legitimacy of substituting names, young bilinguals (ages 4 to 6) were more likely than young monolinguals to agree that this was possible. However, among older children (ages 7 to 9) there was essentially no difference between the monolingual and bilingual children with the majority of both groups recognizing that this was a legitimate possibility. On the second task, however, there was no difference between monolingual and bilingual children (although older children in both groups were more capable of performing the required cognitive switch of names).

In a similar vein Ben Zeev has reported two studies (one of Hebrew-English bilinguals and a second study of Spanish-English bilinguals) using a procedure similar to that of Ianco-Worrall.

She reports (Ben-Zeev, 1976; 1977) that her results for the Hebrew-English bilinguals coming from families in professional occupations showed a greater ability to perform the cognitive switching of names (e.g., this "cow" does not give milk) than monolingual speakers. However, a similar result was not found for Spanish-English bilinguals -- a fact that she attributes to the "lower socioeconomic level" of this sample. (This explanation would, of course, be consistent with our previous discussion of the effects of folk versus elite bilingualism.)

2.6.5 General Cognitive Effects of Bilingualism. The research on bilingualism and cognitive development up to 1962 was almost devoid of any hint that there might be positive benefits for bilingual children (indeed, even the obvious fact that bilinguals could communicate in two languages while the monolinguals were mute once taken outside their mother tongue was seldom noted). Publication in 1962 of a study by Elizabeth Peal and Wallace E. Lambert marked a turning point in the literature. They tested 164 children (75 monolinguals and 89 bilinguals) attending French school in Montreal using a variety of conventional IQ-type measures (e.g., Thurstone Primary Mental Abilities Test, Raven Progressive Matrices Test, and Lavoie-Laurendeau Group Test of General Intelligence -- a test based on the Wechsler-Bellevue and WISC IQ tests). In a remarkably consistent table of results, Peal and Lambert found with amazing regularity that bilinguals outperformed monolinguals both on the overall tests and almost every subscale. For example, of 12 measures derived from the Lavoie-Laurendeau IQ test, 11 showed a

statistically significant superiority of bilinguals (the remaining measure showed a nonsignificant result).

These results led Peal and Lambert to conclude:

that bilinguals performed better than monolinguals on verbal and nonverbal measures of intelligence (Peal and Lambert, 1962:20).

The authors go on to speculate about the sources of the differences in cognitive performance which they observe in their data:

The picture that emerges of the French-English bilingual in Montreal is that of a youngster whose wider experiences in two cultures have given him advantages which a monolingual does not enjoy. Intellectually his experience with two language systems seems to have left him with a mental flexibility, a superiority in concept formation, and a more diversified set of mental abilities, in the sense that the patterns of abilities developed by the bilinguals were more heterogeneous. (Peal and Lambert, 1962:20; underlining added)

These findings by Peal and Lambert begin a marked change in the character of research on bilingualism and cognitive development. Most importantly, there appeared a small number of studies which, given Peal and Lambert's findings, now began to expect and to look for positive cognitive benefits arising from bilingualism. In addition, the results of the 1962 were subjected to careful critique and a longitudinal project using children from the St. Lambert school was launched to examine the long-term effects of bilingual education.

In considering the results of the 1962 study the most important aspect analytically has turned out to be the manner in which Peal and Lambert defined their samples. Children were assigned to the bilingual group if they were balanced bilinguals, which is to say they spoke their second language (English) with

equal fluency as their native French. Ten-year old children who met this criterion, it may be claimed, were linguistically (and/or intellectually) gifted. Thus the inference one should make from the Peal and Lambert finding can be called into question. Furthermore, we must remember that the bilingualism evident in these children was not accidental (i.e., assignment to the "treatment" groups of bilingual vs. monolingual was not in any sense done by a random process). Thus one can ask (as Hams, 1976:261 and McLaughlin, 1978:184 and others propose) whether the experience of becoming bilingual affected the children's "intelligence, flexibility, etc." or vice versa. (To put it crudely, did the smarter children become bilingual, or did the bilingual children become smarter?)

Anisfeld (1964) reanalyzed the Peal and Lambert data to control for the intelligence factor by eliminating subjects until the groups were matched on their Kuhlman-Anderson IQ scores. The results of her reanalysis showed a higher level of performance by the bilinguals on the Raven Progressive Matrices Test (a test of reasoning ability).

The St. Lambert studies in Quebec (Canada) which followed in the footsteps of the Peal and Lambert research and were conducted by a team including Lambert have produced results which might be termed less "positive." In particular, the results are generally characterized as showing that there is no cognitive deficit associated with second language acquisition. In particular, when compared to their English and French monolingual controls, the children who went through the St. Lambert bilingual program were performing at the same level after five years as the controls.

The performance of the children in language, science and math was otherwise comparable -- indicating no deficit attributable to a bilingual education program. There was however no conclusive evidence of a superiority in cognitive or intellectual functioning or flexibility (see, for example, Lambert and Macnamara, 1969; Lambert and Tucker, 1973; Bruck, Lambert, and Tucker, 1973; and review by Hays, 1976:260-263).

Cummins and Gulutsan (1974) studied the effects of bilingualism on memory, reasoning and creative thinking abilities. They also tested out to see if the bilingual child thinks more in terms of images as opposed to words as proposed by John (1970) or vice versa. They tested sixth grade French-English bilingual subjects selected on the basis of three measures of linguistic balance. 61 monolinguals were matched with the bilingual sample on the basis of sex, social class, and age. The subjects were given a limited time to enumerate as many uses as possible for an object named by the experimenter. Their results indicated a tendency for bilinguals to perform better on measures of concept formation and show superior verbal ability.

The results also show that the unilinguals score higher on the spatial ability but bilinguals being superior on verbal ability and verbal divergence tests. The results suggest that bilinguals think more in terms of words contrary to John's (1970) predictions.

Balkan (1970) suggested that the habit of switching from one language to another might enhance flexibility in cognitive development. Two sets of tests (Embedded Figure Type Test) and another one involving a sensitivity to the different meaning of

words were administered to matched bilinguals and unilinguals on non-verbal intelligence. The findings indicated a significant superiority in performance for the bilinguals.

Lambert and Tucker (1973) report that bilingual children by grade 5 generally perform better on measures of verbal intelligence and perform as well as or better than the control groups. Lambert and Tucker (1972) elsewhere suggest a positive correlation between skills across languages. They attribute this to comparing and contrasting of the two languages to formulate rules in understanding complex linguistic functions. Cummins and Gulutsan (in Carey) refer to several studies that support the verbal enrichment of balanced bilinguals, e.g. Casserly and Edwards (1973) report significantly better performance of bilingual children on several measures of psycholinguistic abilities. Kittell's (1963) findings indicate that bilinguals significantly improve in language mental age and reading age. Both studies show increasing greater gains by grade level.

Liedke and Nelson (1968) found that bilingual grade 1 children performed better on a measurement task than a unilingual group matched for age, social class, sex and IQ. The authors attribute the findings to bilingual child's exposure to a wider range of social interaction involved in learning their two languages.

Kessler and Quinn (1979) studied the relationship between subtractive bilingualism and monolingualism in relation to formulating scientific hypotheses and the ability to express these hypotheses in writing. Tests were conducted in English, the second language. 14 monolingual English and 14 Italian-

English subtractive bilinguals were given a series of twelve science Inquiry Film Sessions and 6 discussion sessions, each 40 minutes in length and all conducted by the same teacher. All hypotheses generated by each student were scored on the quality of hypotheses and syntactic complexity. Their results indicate that even subtractive bilingualism has positive effects on cognitive and linguistic development.

Kessler and Quinn (1980) tested 2 monolingual English speaking classes with 32 children in each and 2 Spanish-English bilingual classes with 30 children in each. All subjects were 6 year old sixth graders. The Mexican-American bilinguals were all additive and literate in both Spanish and English. The authors report that bilingual groups showed a higher performance on formulating scientific hypotheses and syntactic complexity in their written language. The authors conclude that,

bilingual child not only has achieved universal types of development described in Piagetian theory but has gone further along the universal to unique continuum, (which) indicates an enrichment often provided in the home and community setting.

Bain and Yu (1978) studied three groups of different bilingual children in Europe: French-Alsatian, German-English and English-French Canadian. Their results indicate significant superiority of bilingual groups over monolinguals on tasks of cognitive flexibility.

Skutnabb-Kangas (1976) tested the developmental interdependence hypothesis proposed by Cummins, (1979). The assumed interaction between the level of competence in the child's first language and the later acquired language of instruction was verified by their findings. They studied 351

Finnish migrant children attending comprehensive schools in Sweden. The older children who migrated at age 10 with a relatively well-developed Finnish achieved proficiency in Swedish with greater ease. The younger children with a low level of Finnish had more difficulties in learning Swedish. The results indicate that in spite of language difficulties, Finnish migrant pupils got through mathematics courses relatively well, in the upper level almost as well as their Swedish classmates. The author notes that,

in the case of migrant pupils, the preservation and development of the mother tongue is limited particularly with success in mathematical subjects, but a dependence on the mother tongue is also clear in the grades for the foreign language and the L3, English.

Oren (1981) tested 49 preschool children on an ability to label and re-label objects. The findings indicate significantly superior performance of coordinate bilinguals in the naming and re-labelling tests when compared to a monolingual control group. It was also found that success in an object constancy test was significantly correlated with re-labelling skills. Bilinguals were also more flexible in dealing with words as symbols.

Duncan and De Avila (1979) tested 204 Spanish-English school children in grades one and three coming from rural and urban backgrounds. They identified five linguistic comparison groups based on the Language Assessment Scales: Proficient Bilingual, Partial Bilingual, Monolingual, Limited Bilingual, and Late Language Learners. They predicted to find significant differences in performance at increasingly higher levels of relative linguistic proficiency (RLP). They also predicted that

the performance of bilinguals would excel on all measures when compared to monolingual children. Their findings indicated a positive and significant relationship between degree of relative linguistic proficiency and cognitive-perceptual performance on measures of the Cartoon Conservation Scales, Children's Embedded Figures Test and Draw-a Man test. The Cartoon Conservation Scale (CCS) is a neo-Piagetian test developed by De Avila (1977). The test is based on original Piagetian tasks, has a cartoon format, each frame representing a premise which two children discuss , ultimately asking the conservation question. The test measures conservation of identity, number, length, substance, and distance as well as egocentricity and perspectivism.

The authors report that the effect of relative language proficiency was significant for CCS Total score and the differences were in the predicted direction. Their finding on monolingual children outperforming the Partial Bilinguals confirms the threshold level of competence hypothesis proposed by Cummins(1979). Limited Bilinguals were found to be performing better on the tests compared to the Partial Bilinguals. The Partial Bilinguals were minimally articulate in one language and limited in the other whereas the Limited Bilinguals were balanced in their two languages. These findings confirm Lambert's , (1978) discrimination and effectiveness of balanced versus unbalanced bilinguals regarding cognitive development. The authors interpret their findings as

superior development of perspectivism or ability to intellectually restructure or reorganize a three-dimensional display; in relative use of separating out part of an organized field from the field as a whole; and in the level of development of articulation of body concept.

They also report that the superior performance of Proficient Bilingual children indicates a greater differentiation, self-other segregation, and autonomy of external referents. In terms of metaset theory (De Avila and Duncan, 1979) the authors note that tendency to "keep things separate" results in breaking of sets which in turn leads to higher order sets or functions."

Ben Zeev (1972) suggests that " the primary effect of bilingualism is on language-learning strategies, and that it is through this channel that bilingualism may affect general thought processes". She extrapolates four mechanisms that help resolve interlingual interference at the structural level of language.

1. language analysis;
2. sensitivity to feedback cues (may involve an ability to switch, responsiveness to social uses of language - correctness);
3. maximization of structural differences between languages (highlighting the general rules and perhaps oversimplifying certain detailed modifications of rules);
4. neutralization of structure within one language involving a generalizing effect.

Evidence for language analyzing comes from Ben-Zeev's (1972, 1976) study of Hebrew-English bilingual children from middle class professional career families and also from a study of Spanish-English bilingual children of low socio-economic class (Ben Zeev, 1975, 1977). Ben Zeev's findings indicate that the Hebrew-English bilinguals were superior to the monolinguals in ability to play with words, which may be a consequence of increased language analysis. Contrary to these findings her Spanish-English bilinguals did not show any superiority in word-play task which may be due to the "restricted code" of speech

typical of lower classes (Bernstein, 1971). The author concludes from these findings that positive effects of bilingualism may be fostered in high-educated level families with special interest in the languages spoken and pride of being bilingual on the part of the child. Ben-Zeev asked her subjects which language they spoke best and also which language they liked best to establish the nature of their self image as bilinguals.

For the Hebrew-English study the children were required to replace one part of speech by another which normally would not be correct. The author suggests that the word to be replaced was "semantically" meaningful and could easily lead to mistakes because it carried all its connotations with it. For example:

Instruction: For this game the way we say "in" or "into" is to say the word "clean." See this doll. See this house.

Question: Tell me where the doll is going?
(Experimenter pushes doll inside of house)

Correct answer: The doll is going clean the house.

Question: Does the doll house get cleaner, dirtier, or does it stay the same when the doll does that?

Correct answer: It stays the same.

The findings show the Hebrew-English bilinguals were significantly superior to control groups from equally well educated families. On the other hand Spanish-English group, were unable to treat the sentences analytically although when types of errors were analysed the author found that in comparison to their monolingual control group the bilinguals (Spanish-English) made significantly fewer errors of a primitive type.

When the performance on a symbol substitution task was

compared to their vocabulary performance, the bilinguals were found to be superior although they made significantly more grammatical mistakes. The author suggests that symbol substitution does not depend on mastery of particular words or particular production rules but to the separateness of language structure and semantics in which it is embodied, and that is, "arbitrary and subject to change, rather than immutable or in the nature of things."

The Spanish-English group were given^a a test of ability to classify and reclassify. Each test required the subject to switch to another type of classification of the same items and again change the strategy in reclassifying. One of the tests was (based on Inhelder and Piaget, 1964, Chapter 7, part 2). The bilinguals performed better on both parts of the test.

The Hebrew-English bilinguals were given a test of matrix transposition (Bruner and Kenney, 1966) . The child was presented with nine cylinders which varied in three degrees of height and three degrees in diameter, such that they formed a 3x3 matrix. The child was asked to transpose the matrix and also describe it. The findings of this test showed that the bilinguals were superior in naming the underlying dimensions in the task.

With the Raven's Matrices Test the skills required were similar to those required in matrix transposition. Both tests involve what Piaget calls "multiplicative classification" in which the two dimensions of a system must be attended simultaneously. The results showed no group differences yet the Hebrew-English bilingual group were better in resisting the error

of simply choosing the response item closest in the choice point. The author notes that they employed a more analytic strategy in choosing their response items.

To test the sensitivity to feedback cues the author introduced hints to draw the child's attention in situations where the child was stuck to classify by shape, e.g., round and square. By including triangles in the set two category classification was impossible. The bilingual children picked up such cues quickly and were more successful in restructuring.

The author also observed that in classification tasks the children paid unusual attention to all the details of the items trying to subclassify to the point where they lost track of the levels involved and described their classification performance in terms of subclasses instead of classes.

In general, regarding the kinds of cues they had to deal with, the bilinguals paid more attention to the details of structure, perceptual indications of error and interpersonal cues.

Ben-Zeev used a test in both of her studies to produce the illusion of speech, where a nonsense word is repeated() continuously by means of a tape loop and the subject must report what he hears. In both studies, the bilinguals were found to be significantly more susceptible to this illusion than the monolinguals perceiving more changes and more different type of words. The author interprets the high auditory number of changes in the verbal stimulus as a consequence of increased processing effort on the part of bilinguals in an attempt to make sense out of the stimulus showing an absence of closure.

Ben-Zeev's overall conclusions from her studies concerning the hypothesis that the attention to structure and the readiness for reorganization which the bilinguals manifest in relation to language structure is generalizable to other kinds of structures is partly supportive. The two tasks which related to this hypothesis were matrix transposition and Ravens Progressive Matrices. The bilingual children were not found to be superior in reorganizing the matrices, however, on the verbal part of the Matrix Transposition Test, in which the child must isolate the basic dimensions underlying the matrix, the bilinguals were significantly superior. Ben -Zeev's interpretation of the findings is,

it seems, then, that there is some general carry-over of the strategy of attending to structure, in language, resulting in a more analytic orientation to structures, but that it does not extend to a general ability for reorganization of structures. On nonverbal structures it seems to take the form of attention to the basic dimensions involved and the range of forms involved. This is essential but not in itself sufficient for system organization. This kind of attentional strategy would be most useful in situations in which it is important to note the major details.

Ben Zeev (1984) summarizes the interdependence of bilingual language proficiency and general cognitive ability in these words:

When faced with interference, the child tries to simplify his environment by ignoring one of the languages. At a higher level [of proficiency] he develops special discrimination skill. At a still higher level of skill he internalizes each of the language structures, to some extent, so that he need not rely on the external situation for discrimination purposes. In this case he may achieve an unusual level of metalinguistic understanding both in terms of the understanding of grammatical structure and perspective taking. (Ben Zeev, 1984, p. 77; emphasis added)

2.7 POSTSCRIPT

What might we conclude from these studies showing positive effects of bilingualism on cognitive development? It does seem that there is a positive correlation between linguistic awareness and cognitive awareness. To summarize this conclusion in Piaget's (1974) words:

"becoming aware" is a mental activity of a special type that interacts with other cognitive activity on which it depends and which it can modify in turn.

Chapter 3

TURKISH VILLAGE CULTURE AND THE MIGRANT EXPERIENCE IN GERMANY

This chapter describes life in Turkish villages and the migrant experience for readers who may be unfamiliar with these topics. Since village life provides the "baseline" and migration the "treatment" in our quasi-experimental design, it is important to appreciate the character of Turkish village life in order to understand the nature of this research. We begin this chapter by describing the social structures that are prevalent in villages generally. Subsequently we discuss the life of the village farm family (Section 3.2), the role of religion in village society (Section 3.3), and the impact of secular education (Section 3.4). In the final section (3.5) of this chapter we describe the social life and experiences of the Turkish workers who migrated to Germany during the 1960's and early 1970's. (Readers interested in further details of Turkish village culture and the migrant experience may wish to consult van Nieuwenhuijze, 1962, 1980; Castles and Kosack, 1973; Lerner, 1958; Daral-Kashaf, 1957; Levy, 1957; Paine, 1974; Szyliowicz, 1973.)

3.1 VILLAGE SOCIAL STRUCTURE

As described by Nieuwenhuijze (1962) the Turkish village is "a microcosm, usually embedded in a larger cosmos of village life, the radius of which is more or less determined by the natural limits of pedestrian traffic or by geographical conditions." Generally villages are situated in a wide plain

(ova) between slopes of mountains. The village plays a passive role in regard to the changes and dynamic factors affecting the power structures of the urban life. Even though the village may supply manpower and thus economic power to the urban sector, "it is passively integrated into the whole system where it can never be considered as a social, economic, political and administrative unit in its own right." Since the village is a subsistence economy rather than a (wide) market economy, the economic life is limited by its boundaries by the villagers' productive and processing capacity.

3.1.1 Communications. In respect to communication of information the village is more or less a closed system. It plays a passive role in communicating information with the outside world, and incoming information may not be fully grasped by villagers:

an event occurring in the outside world will not merely suffer a time lag in affecting the village, but in addition there is likely to be a discrepancy in meaning" (Van Nieuwenhuijze, 1961).

Normally the only mass communication agent in a traditional village is the radio in the public coffee house. Most of the radio information is taken in selectively according to the villagers' needs and interests, it serves essentially practical ends. Newspapers do not reach these villages. Even if they did, the adult population is mostly illiterate. The on-going events in the nation or around the world do not thus have the same impact on the cognitive map of the villagers as they would on people who experience these events closely and directly.

3.1.2 Authority. We could say the same thing in connection

to authority perception. Since village life and the urban life are not actively integrated, neither are the value systems of their respective groups. Usually the man whose opinion carries most weight in the village and the government official appointed by the central government are the same person: the muhtar. Order is kept traditionally by observing the rights of the people involved as they see them, rather than by an objective judicial system. Decision making and the administration of justice in such situations can thus produce great conflict and confusion. Those who are not satisfied with the decision of the power structure may take justice into their own hands and the disputes (in most cases land trespassing and violations of family honor) turn into blood feuds that can last through generations.

Justice is enforced by organized groups who claim a common right and obligation to avenge injuries inflicted upon other members of the group. The membership in a vengeance group is determined by descent from a common ancestor. Violent settlement of disputes can cause a blood feud which begins when the member of one family is murdered. The victim's relatives then seek to avenge the crime, attempting to kill the murderer or one of his close relatives. Obtaining an "eye for an eye" becomes a religious obligation.

Where there is conflict between the village and the government authority, people are more inclined to accept the decisions of the authority figure belonging to the community rather than the official one. In some cases what seems to be the best solutions to a law enforcing body may not bring peace and order to the village; on the contrary it may provoke further

disorder.

The lowest level of official authority that is in contact with the villages are the jandarmes who report village crimes to the police station in the nearest town. In violent cases, the people involved are taken to the police station. The authority figures in the village generally include the imam (religious leader) who does the teaching of the Quran; the muhtar, the elected village leader; wealthy land owners; the returned pilgrims from the holy city of Mekka (Haci); and the oldest family group which may be said to be the village founders. It is not unusual to find villages named after their founders, e.g. Hayrioglu, ("son of Hayri").

3.1.3 Social Life. The socializing patterns of men and women vary according to their activities. Men gather among themselves either in the coffee house, the little grocery shop, or the muhtar's house. The latter is an important social gathering place in villages where coffee houses are not available. Here the important issues concerning the village are discussed, information is exchanged, bureaucratic formalities are taken to record the birth of a child, the death of a member of a family, military registration (draft), and civil marriages. The muhtar's house also serves as an unofficial post office where mail brought to the village by hand is distributed and read to the recipient, and also collected to be taken down to the coastal village where an official post office is present. The arrival of strangers in the village is immediately reported to the muhtar who in turn investigates who the person is related to, the nature of his visit, and the duration of his stay. The muhtar's house also frequently serves as the village "guest house".

The socializing of women is quite a different story. They are not directly involved in controlling the events in the village. Since men are the decision makers, there is not much left to be said by women. Their exchange of information is mostly limited to gossip. There is much visiting back and forth among women of different households. In the evenings a group of women walking along the paths carrying gas lamps or torches is a common sight. In these gatherings young adults often sing folk songs about young husbands away on military duty (which is compulsory for all men at the age of 18) and dance to the rhythm of the tambourines, striking together wooden spoons to accompany the tambourines. The women get a chance to be exposed to a wider circle of people when they take their crops to the market place once a week. Otherwise, women are mostly involved in working the land, hauling water from the common well, baking bread and washing clothes by the river banks or at the communal water supply. Other activities include drying dung cakes, tethering animals and drying crops (mostly corn, beans, peas, etc.).

3.1.4 Education in the Village. There are two levels of education in the villages, one being the traditional religious form (Quran recitations), the other the secular education that is imposed by the central government. Every child between the ages of 6 and 13 is required by law to attend the nearest school in the area. (Those parents who do not send their children to school are prosecuted and may be heavily fined. Distance is no excuse even in instances where the child has to walk 30 to 40 minutes along goat paths in order to get to school).

Nevertheless, village parents in general do not think formal

education has any fundamental value other than being a means to literacy. The traditional religious education is viewed as the source of wisdom and knowledge. They see secular education only as a mediator between the village life and the dealings of the bureaucratic urban life. Formal education is not seen as a way of acquiring competencies that enable one to control and solve problems encountered in real life. The mastery of professional skills and scientific knowledge (that enable one to earn a living by selling one's services within a complex socioeconomic system) is something alien and distant to the village person.

When village boys and girls were asked before our testing sessions, what they wanted to be when they grew up, the answers usually involved traditional roles modeled after their mothers and fathers. They were all within the manual labor category (mechanic, lathe operator, sand diver, waiter, cook, soldier, field worker, etc.). Except for one boy (who said he wanted to be a doctor), the children's answers were consistent with the traditions and expectations of the village.

On graduation from primary school, the Turkish Ministry of Education conducts a nationwide examination, which provides full scholarships to talented village children who can attend secondary schools (as boarding students) in nearby cities. In the final year of primary education, teachers advise the parents of the brightest village children to consider this option and enter their children for the examination. Even though the teachers are willing to assume the responsibility of taking the children to the nearest town for the examination and to aid in the bureaucratic process, the parents' attitude was usually quite

negative. When girls were involved, the issue was simply out of the question. As far as the boys were concerned, the parents often either needed them in the villages to herd the cattle in the pastures, or parents sought short-term economic advantages by sending the boys to the nearest town where a relative was established in order to acquire a manual skill, or by having the boy do odd jobs (e.g. as a helper in a coffee house, shoe-shiner, etc.) and contributing to the family income.

The general attitude of the villagers toward the young male and female teachers who were sent into the villages by the government was not very positive; in a way, they were regarded suspiciously by the village people. All in all they were considered outsiders. There was no attempt on either side to bridge the gap. The teachers showed little empathy with the feelings of the villagers when there was conflict, since they had no interest in the village other than completing the time period of their compulsory appointment.

3.2 THE VILLAGE FARM FAMILY

3.2.1 Family Structure. The village families generally consist of large households including great grand-parents, an older couple, their off-spring married or unmarried, and a number of children. Normally the oldest male is the head of the household. He makes all the decisions for the family and retains the property in his name. Adult sons and their wives work for the entire family and share its fortunes. Unmarried daughters also participate in the labor^u. Small children, when out of school, help with the animals (usually cattle) by taking them to

pastures in the early hours and making sure that they all come back to the village before sunset.

3.2.2 Marriage in Villages. In many societies marriage is the most important form of exchange which establishes a bond between groups. The daughters are "given away" to their husbands and to the husband's families. Traditionally, a man pays the family from whom he takes a daughter in marriage a "bride price" (baslik). This money is then often paid out to some other family for a wife for one of the recipient family's sons. This is not to say that women are "sold" and "bought" casually. On the contrary, villagers place a high value on a woman's labor and her reproductive capacity, and this insures that neither the couple nor the families take the marriage lightly. Thus, customs extend the marriage contract beyond the death of a spouse. In cases where the husband dies, the brother has the right to marry his widow, or to demand return of the bride price if she chooses to marry somebody else. The brother in-law is obligated to provide for the widow and her children.

In the villages a man has the right to remarry if his wife is proven to be barren (infertile). In such cases the woman gives her consent to her husband to choose a new wife and continues to reside in the same dwelling, if she wishes to do so. Marriages between first cousins are common; an uncle's son or daughter on the father's side is considered to be a very desirable match.

Families take great care in arranging suitable matches, but there are always exceptions to this rule. Young people falling in love with another in spite of the family's intentions may decide to elope together to consummate their love. This may also

be done to avoid paying the bride price asked by the family. Elopement takes place by the husband-to-be "kidnapping" the girl and spending the night with her. Virginity, a highly regarded characteristic in a bride, in this case is blemished. This fact diminishes the girl's chance of marrying somebody else, and thus ensures her continued stay with the "kidnapper."

Once the girl marries she is absorbed into the husband's kin group and is subject to its authority even though they may not be sharing the same home. In general, extended family patterns are a way of life, where every family member contributes to the family labor in order to sustain their survival.

In a traditional family, the young bride breaks ties with her family and joins her husband's family living under their supervision. She has no say in running the household until she bears a son and gains some status in the family. The mother-in-law is the power in such extended families. The relationship between her and the new bride resembles the apprenticeship between a master (usta) and a young boy (cirak) developing the skills of some craft.

3.2.3 Family Law and Tradition. In 1926, after Ataturk's revolution had overthrown the Ottoman sultan and established a republic, the government adopted the Swiss civil code to replace the Shari'at (Islamic law) provisions governing marriage. This permitted an equal right to women for divorce, and also allowed marriage between Muslim women and non-Muslim men. The new family code did not have a great impact on village life, however. Illegal religious marriages still took place, producing "illegitimate" offspring. To legitimize these children, the

government then had to pass bills in the 1970's to issue birth certificates to the millions of village children born out of civil wedlock.

The kinship structure in the Turkish culture is patrilineal. In 1935, the family name law required that surnames pass from father to children and from husband to wife. After the death of a father, the wealth is divided between sons, and thereafter, each son becomes the head of his own household to start his own extended family. Money earned by all the members of the family is used to build quarters for the married sons, for dowry, bride price, and wedding expenses. Weddings usually take place in late summer after the harvest time, and villages may have multiple weddings lasting several days, adding life and joy to the village with its festivities. Musicians and dancers from the town are hired for the occasion. Traditionally the bride leaves her home on a horse that has been decorated with beads and colorful ribbons. Her head is covered with a veil until she joins the groom at her in-laws place where the ceremony (imam nikahi) takes place.

3.2.4 Housing. The layout of villages does not follow an organized plan. Houses are clustered together providing proximity between related families. These clusters form a community (or extended family) spirit where people live together sharing daily life. Middle Eastern culture places a high value on relationships based on the extended kinship group, thereby increasing the number of primary ties each individual maintains (compared to the nuclear family common in the West). Even though people own farming land at some distance from the villages (e.g.

one hour's walk) they do not live on the premises as might be done in farming villages in the West. The villages themselves are usually quite far apart and the only connection is usually a trodden footpath. The mosque plays an important role in the life of each village and it is centrally located.

3.2.5 Diet. The village diet consists mainly of grains, potatoes, corn, seasonal vegetables, yogurt, and eggs. Meat is rarely eaten, except during weddings and at Kurban Bayrami (a religious holiday). Chickens are slaughtered by young boys when there is an important guest to be entertained (but great care is taken to find an old chicken that no longer lays eggs.)

3.2.6 Equipment. The equipment and machinery used in these villages are simple and traditional. The village farmers rely upon hand tools and animal drawn equipment. Among these are two kinds of plows: the needle plow (saban) that is used for rocky ground and the steel plow (culluk) used on the plains. A harrow (surgu) is used to smooth the soil after it has been plowed. Other tasks are performed on the knees with a short hoe and shovel. Harvesting is done by hand with sickles (orak) and threshing is done using horses or oxen power. Winnowing is also done by hand with wooden forks. Afterwards the grain is sieved and cleaned by hand before being stored in jute sacks. The straw is made into bales and then stored away to feed the animals in winter. The same thing is done with corn. The corn kernels are separated from the cobs. The cobs are then stored for feeding to the cows.

There was a mill in almost all the villages I visited. Depending on the location of the village, the mills were either

windmills or watermills. The villagers carried the sacks of grain on their backs to the mill and ground it to make bread. Some houses had hand-operated stone mills where grinding was done. The elderly and non-farming families would buy corn and wheat and have them ground in exchange for some other goods, e.g. eggs, yogurt, etc.

Irrigation was done by hand in the small vegetable gardens, but otherwise people relied on rain. Because of this dependence on natural conditions, plowing, sowing, and harvesting were carefully timed, taking into consideration the traditional experiences of the older villagers whose memories provided an oral almanac that has been verbally transmitted over several generations.

3.3 THE ROLE OF RELIGION IN VILLAGE SOCIETY

The social structure of Turkish culture is mainly based on its religion, which is Islam. During the Muhammedian period in the Arabian peninsula where Islam originated, there was chaos, corruption and rivalry among the Bedouin settlers. Islam served as a unifying force bringing social order to this area. Turks were the primary protectors of Islam throughout the Ottoman Period i. e. from 1492 up until the end of World War I.

After the Turkish Republic was founded by Mustafa Kemal, Turkey adopted "secularizing" laws (March 24, 1924) which separated religion from economic, political and other social spheres of action. Magnerella (1974) has observed that this process of secularization may have cognitive as well as cultural consequences:

This process (secularization) produces two basic alterations in human thinking. First it removes the sacred element from attitudes held towards certain persons and things. Secondly, it creates a rationalization of thought. People begin to think about the world and their activities on logical empirical grounds without reference to sacred symbols. They believe that worldly objects can be manipulated to their benefit on the basis of scientific principles unencumbered by religious prescriptions. This secular world view becomes the mode of thought in the public sphere and relegates religion to the private sphere of individual conscience.

Magnerella analyzes Islam in terms of five interlocking systems to clarify this process of secularization: the power-authority system, the regulative system, the socialization system, the value system and the ideological-ritual system. (See also Ismael, 1970: 43-48). We will briefly describe some of these systems in order to better our understanding of the Turkish culture.

3.3.1 Power-authority System. Islam embodies a social and ethical code of behavior used to run military and governmental affairs, and it was applied by religious judges as a judiciary system. The Sultan had supreme authority in all spheres. His word was law. His approval (Fetva) was needed to declare any news or to make amendments in all important sectors of public life. He was also the Caliph, the spiritual leader of all Muslims in the world. After the abolition of the Caliphate and the religious hierarchy, the power and influence of the Islamic law administrators was taken away.

3.3.2 Regulative System. Shari'at, the divine Islamic Law, was the only regulative system. (It was later replaced by a legal system adapted from Swiss and Roman Laws.) Thus civil, commercial, penal and governmental activities were governed by religious law until the revolution, and afterwards by Western secular laws.

3.3.3 Socialization System. The formal Islamic education given at medresses (schools) mainly consisted of Quranic studies. Informal education was left to the family and the community. In modern Turkey formal education has been Westernized. (Separate religious schools are also available for those who want to pursue religion professionally or privately.)

3.3.4 Value System. The ideal behavior of the traditional Turk is personified by his religion, i.e., being loyal, trustworthy, courageous. To quote Magnerella (1974):

The idealized Turk is courageous, brave and strong; moderate in all activities; respectful of the learned and elderly; loyal to kin and friends; guided by a keen sense of honor and shame; concerned with his and other's dignity; patient and enduring in the face of hardship; and generous, hospital and friendly.

All these personality traits can be found in the Quran stated as virtues, e.g.,

When you observe four things, there is nothing in the world that may not cause you bliss: guarding of a trust, truthfulness in speech, good conduct, and moderation in (eating, drinking, and living).

The food of one is sufficient for two, the food of two is sufficient for four, and the food of four is sufficient for eight.

3.3.5 Religious Beliefs and Attitudes. The sociologist, Emile Durkheim (1961), argues that the essence of religion is not a specific set of beliefs, attitudes or practices, but an expression of a community's moral values and collective beliefs. Similarly, Geertz (1966) argues that religion is essentially an ideology or system of symbols that has a powerful emotional appeal and can provide a rationale for human existence.

Religions may serve as models of how the world is organized and how one should behave to fit this order. Religious beliefs and rituals provide explanations to unfathomable phenomena (life and death) and also contribute order and stability in a society. These two important functions can be termed psychological and social functions.

3.3.5a Psychological Functions. Religion reduces individual anxiety by giving answers to unavoidable consequences of human life and the physical world, such as illnesses, death, calamity, earthquakes, etc. Religion provides cognitive explanations about events beyond one's control. Religion also supports one in such stressful occasions by providing the consolation and support shared by millions of people who believe in that particular religion. Thus, in the villages, where there is no access to doctors or medical facilities, people often put their faith in religion and prayers for recovery.

3.3.5b Social functions. Every religion has a social function in that it dictates ethical behavior and defines right and wrong by approving and disapproving of behavior with the authority of the "word of God". Since the fear of the unknown causes discomfort, disobedience may bring about anxiety and conflict. Those who go against God's words are promised punishment, if not in this world, then with no doubt in the next.

Islam teaches communal responsibility and humility, wherein people provide for each other's needs, share their food and look after the sick and the needy. Islam also teaches that all men are equal in the eyes of God. The following quotes from the Quran indicate some of the behaviors that are revered:

When you see a poor creature, do not look at him with disdain.

He who has pride, gets destroyed.

Don't give your heart to the world.

He who lets himself be caught by the world falls far from Allah.

Every good deed is charity (sevap), and it is a good deed to meet your brother with a cheerful countenance and share with others.

Eat together, not separately, for the blessing is to eat with company.

Islam also stresses the golden rule (do unto others as you would like others to do unto you). Thus the Quran says: "Virtue is good conduct and vice is thoughts which if known by others would be shameful." Similarly the Quran notes: "You will recognize the faithful, for they show mercy to one another, love one another, and are kind to one another, as if they all were of the same body. When one member of the body ails, the entire body ails." These teachings of the Quran reinforce a collective attitude of life as something that is shared with others; this is at odds with the individualistic attitudes and competitiveness that are valued in the West.

The mosques in Islam are not highly structured institutions of ritual and control as is in Christianity (particularly Catholicism). Islam strictly preaches that nothing comes between men and God; there is no agent or mediator of any sort. The main emphasis is on the "conscience" of the self. This promotes self-control and internalization of the value and the ethical system through which people come to adopt a common way of life and thereby form a closely bound society and culture. Any deviance

or violation of these values stirs a lot of emotions among the believers. Some rules are so deeply internalized that the very thought of trespassing them is intolerable. [E.g., the sanctity of women in the family (mother, wife, daughter) is so terribly important to a traditional person that any remark taken as an assault on their virtue is enough to stir extreme violence in defense of the family's honor.]

Having looked at the dynamics of religion in people's life, it should be clear that any value, moral or justice system, that is presented from outside, would clash with the already existing behavior and attitudes of traditional village life. Thus, the traditional villagers regard the police, governmental officials, social workers, and teachers with fear and suspicion, perceiving them as intruders. Secular education is seen as a particularly serious intrusion into a sacred realm which should be left to mystery or approached only through religion.

3.4 SECULARIZATION OF EDUCATION IN TURKEY

As the result of the secularization process begun by the revolution, religion was separated from education. (Religion became a matter of personal conscience.) The new educational system, based on scientific thought, became the foundation of a rationalist, secular culture. In August 1925, Mustafa Kemal (Ataturk) delivered a speech on the importance of this secular revolution:

The aim of the revolutions which we have been and are now accomplishing is to bring the people of the Turkish Republic into a state of society entirely modern and completely civilized in spirit and form. The superstitions dwelling in people's minds will be completely driven out, for as long as they are not expelled, it will not be

possible to bring the light of truth into men's minds. . . I flatly refuse to believe that today, in the luminous presence of science, knowledge, and civilization in all its aspects, there exist, in the civilized community of Turkey, men so primitive as to seek their material and moral well-being from the guidance of one or another seyh [religious leader] . . . The straightest, truest Way. . . is the way of civilization.

To spread this new way of civilization, a nationwide system of compulsory secular education was designed to convert the traditional minds of the religious population to a modern "Western" mold. A large group of villagers were trained as teachers over a short span of time to realize this objective. At the beginning, this secular education was quite practical and general in content. Later, education became more structured and formalized after the Western system. Nowadays, in primary schools the children are taught Turkish language, history, geography, natural science, mathematics, writing, music, drawing, and physical education.

As noted previously, the village teachers are young people newly graduated from teachers colleges or universities; they themselves usually come from villages or small towns. Their assignments are a result of a lottery and not of free choice; their service is compulsory in return for the government scholarships which provided their education. These "modernized" teachers are not always in rapport with the village people. Since they often look down on the old traditional ways, they sometimes come into conflict with traditional ways of behavior and ideology prevailing in the village.

To succeed in school work, village children often feel they must literally memorize given texts to reproduce answers verbatim. This tendency may be traced back to the traditional

education of memorizing and reciting the Quran (Magnerella, 1974). Unfortunately, the teachers' expectations of the students is often not any different. From my own interactions with the village children, I observed that when children were posed a question they looked for an answer which was "expected", creativity in thinking was not encouraged. I also noticed that children were in great fear of saying the wrong things or giving the wrong answers and consequently being punished. (Punishment was either corporal or else children were sent out of the classroom or made to stand on one foot for the rest of the period.)

In school, as elsewhere in village life, children are expected to say only what they are "supposed to say" when in presence of adults -- which generally means to repeat what they are told with no questions asked. Confronting a person in authority (teacher, elder or parent), leadership, curiosity, competition, and taking initiative are traits that are considered undesirable. Traditional Muslim teachings on education and the role of the teacher reinforce these notions. Shalaby (1954: 175), for example, quotes traditional Islamic injunctions that student should

Honour his professor; not precede him when walking together, nor open the conversation without his permission, and lastly choose suitable times for seeking his advice. (Al-Ihya, I:39)

In seeking knowledge remember the Prophet's saying: "Do not learn for the sake of conceit, or for attracting the attention of rulers (Al-Ihya, I:113); and not for the vanities of the world either (Al-Zarnuji, Ta'lim al-Muta'allim Tariq al-Ta'allum, 7).

At the same time one should not lose sight of the fact that

learning and scholarship were widely respected -- indeed that is doubtlessly the reason behind the injunctions to the student to revere his teacher. In the Traditions and Sayings (a body of Quranic interpretation), the faithful of Islam are instructed

Learned people are the heirs of the prophets.

Learned men and warriors constitute the next class to the prophets.

3.4.1 Literacy and Formal Education. The function of literacy and formal education is to enable one to extract knowledge from one's actions and to open the way to abstract thinking. This aloofness from direct experience is also reflected in the language spoken. When an illiterate peasant is asked to describe a certain way of operating a tool or machine, he finds it almost impossible to describe his actions, so he chooses to show the way by acting it out. The same is also true when he is asked directions to a certain place. Since he has not ordinarily been confronted with the problem of extracting the knowledge linguistically to transmit it to another, he is often satisfied by giving vague information with no specifications. Formal education enforces clear-cut definitions, labeling, and categorization to reduce doubt and vagueness in issues and matters in question. Even visual perception, which we assume to be biophysiological and therefore likely to be universal, is greatly influenced by formal learning. A. C. Mundy-Castle (1966), for example, showed four simple line drawings to a group of children in Ghana. Any Western child would have perceived that the elephant in these line drawings was some distance beyond the man and the deer depicted in all four drawings. But Chanain

children failed to make this observation. The fact that the elephant was small in proportion to the other figures did not evoke the impression of distance in their minds. Mundy-Castle associates this two-dimensional perception with a lack of experience with picture books, drawing material, etc. Perceiving depth in a drawing on a flat surface is an acquired skill in Western culture. What the Ghanaian children lacked was familiarity with a certain symbolic technique, a particular culturally learned reality. Although this technique may be perfectly common to the Western mind, it is by no means universal (D'Andrade, 1973).

While testing children in the Turkish villages, I came across some deficient labeling performance where colors and shapes were concerned. For example, village children generally labelled the color blue as sky, the color brown as earth, the color yellow as egg yolk. Similarly, they used the word chicken to identify a drawing of a bird, wheel or round tray for a drawing of circle, window for a drawing of square or rectangle, etc. (This does not necessarily mean that village children don't differentiate between colors and shapes the way we do. A more reasonable conclusion is that the challenge they have been previously confronted with in this respect has been minimal.)

3.5 MIGRATION

After World War II, the industrial labor-short countries of Northwestern Europe imported unskilled workers from Southern Europe and the Mediterranean countries, to facilitate their economic growth. War casualties had sharply decreased the number

of younger workers, birth rates had changed, and post-war emigration to the United States and Canada had further broken the backbone of the labor force of these countries. Turkey, along with Yugoslavia, Greece, Italy, Spain, Portugal, and Algeria, were the main sources of these imported workers. For this purpose, France, Holland and Germany established recruiting offices in these countries to enroll volunteers. According to the Turkish-German bilateral agreement of October 31, 1961, Turkish workers would sign contracts of one year's duration during which they would assumedly acquire industrial skills and experience while saving money and sending home remittances. On their return back to Turkey, another group of unskilled workers would be sent. This model of development also seemed very profitable for the Turkish economy in counteracting its severe unemployment problem.

After the agreement was signed and labor recruitment centers established in Turkey, the unemployed peasant population rushed into the cities where recruiting offices had been opened. The waiting list for migration reached 500 thousand names in 1965 and more than one million by 1970 (Penninx, 1983: 791). After applying to the nearest office for an interview, a worker had to wait until notified of a vacancy in the host country. Migrants to Germany were processed in Istanbul. Having taken a medical examination and completed all other bureaucratic requirements, the worker was sent to his destination with all his expenses paid by his future employer.

These initial labor contracts in the 1960's could be extended another year, but this was intended to be only a temporary work

experience where no families were involved. But events took another course, and the term "Gastarbeiters" given to these workers turned out to be ironic. The duration of the stay in the contract had to be changed to "indefinite", because the initial agreement proved to be impractical. Employers were reluctant to undertake new efforts and expenses to replace these (trained) workers once they had started efficient production. Workers, as well, chose to stay in their new environment because of financial benefits. However, emigration continued since the demand for additional manpower was so great.

The export of migrant labourers occurred quite rapidly once the bureaucratic apparatus was in place. In January 1963, Penninx (1983: 785-786) notes that there were only 22 thousand Turkish workers in West Germany, but by 1966 this number had reached 161 thousand, and it continued to grow throughout the 1960's. By 1974 there were over 600,000 Turkish workers in West Germany, and they were accompanied by about 200,000 children.

This influx of workers to Germany brought new problems for the host country. Since the receiving countries in Europe had not anticipated these workers' semi-permanent status, they were faced with severe problems in housing, welfare, and education.

Following the energy crisis in 1973, Germany closed all the recruiting offices in the labor-sending countries and brought migration to a halt from nations that were not members of European Economic Community. This new decision spurred adoption of an integration policy for presently employed foreign workers. Integration had important consequences in respect to family reunion, employment of women workers and the education of their

children.

In 1979, the Turkish population in West Germany amounted to over 1.2 million.

3.5.1 Migrant Adjustment to City Life. When these migrants changed geographical environment, they entered a new social system which caused important changes in the quality of their social relations. In their new environment the migrants are affected not only by the changes in the new system they are joining, but also by changes in their direct contacts with people.

Socially the migrant must wean himself from the intimacy of the village to the more superficial relationships inherent in the urban life as he adjusts himself from the homogeneous peer group of the village to the varied reference groups of the city. Culturally he is expected to undergo a revolution in motivation, values, ideology, norms, needs, reference groups, etc.

3.5.2 Adjustments to Western-Urban Society. In relation to our research, our main interest lies in the understanding of these socio-psychological changes that the migrant undergoes to adapt to a new cultural setting. When people migrate from rural areas to an industrialized milieu, the physical surroundings changes from nature's open space to a highly complex urban setting with its boundaries and regulations. The village home is replaced by tall apartment buildings where numerous people are housed. This may result in overcrowding more severe than in the villages. Many families using a common staircase and public utilities (e.g., bathrooms outside the apartment units shared by others) which may mean more intensive contact with the (non-

family) neighbours than in the village. Adjusting to such forced intimacy may be extremely difficult, particularly for women from traditional Turkish villages.

The dress code also undergoes some change. On Sundays, men are dressed in their recently acquired new suits, white shirt, and tie. They are seen strolling in the Berlin streets, milling around the Zoo Bahnhof (train station), and visiting the parks and Tiergarten with other men in their spare time. For women the change in dress presents a different problem. Since traditionally the peasant women are expected to be fully covered with shawl-like scarf over their hair to minimize the identity of the person, their adaptation to Western dress is usually a high-necked, long sleeved, colorful dress with a kerchief completely covering the hair.

The migrants' means of daily transportation has changed from pedestrian dirt roads to structured streets and scheduled fast metro and bus systems. The migrants also enjoy acquiring some basic consumer goods. Among the objects high in status found in most homes are wardrobes, china closets, a high poster bed with shiny bedspreads, high pillows, night lamps. All this is very "modern" to the migrants, since in their villages they lacked electricity and they traditionally sleep on mattresses that are rolled out for the night and put away during the day. Furniture, including chairs and tables are not used in peasant homes. A low level sofa type of sitting place is most common or else they sit on floors that have been covered with rugs.

In the city life, the closed social control system common to rural life is broken down. There is greater freedom for

individual differentiation. In the villages, almost everyone is engaged in agriculture. Men work hard during the sowing and harvesting periods which are followed by idle seasons (winter) of maintenance and community social interaction. The coffee shop back home was the central place where males conducted their social and often business lives. The communal water well was a social gathering place for women where laundry was done outdoors and gossip exchanged. In the cities, the women have become more restricted in their social life. They spend more time at home as housewives with their children. Unless they join the work force, they stay quite segregated within this complex society. In the villages, the children took care of themselves. But in Berlin, it is through their children that migrant mothers establish social contact with the outside world. And, indeed, in many cases, children act as interpreters for their parents when dealing with other members of the host culture (shopkeepers, doctors, officials, etc.).

Turkish migrants upon emigrating to a Western culture are faced with a very specific problem in communication. Their effectiveness and social functioning is restricted by the degree of their competence in the language spoken in the host country. To counteract this barrier the migrants stick to each other and use mediators to deal with officials. Young children of school age (6-12) do not generally have much difficulty in learning a new language as long as they are in a favorable environment, such as attending a school where the language of instruction is German. Owing to the rapidity and ease with which these children learn foreign languages they often form the link between their

families and the rest of the host culture.

3.5.3 Work Environment. In agricultural societies, the person who makes the tool sees the product from start to finish and owns it until it is sold. In industrialized societies, however, the relationship between workers, their tools, and products, is quite disintegrated. The factory workers who make machinery will probably never use any of what they produce. They are involved only in a specific and limited portion of the production process. They are simply selling their labor to a business firm at a rate set by the demand of the market system. Labor, then, becomes a commodity like any other. Alienation, the fragmentation of relations between individuals, their work and ownership of products and capital resources, is one consequence of industrial specialization and private enterprise. Each laborer is hired to accomplish a designated task in the total production process.

Family size and structure is different in many aspects for the migrants. One sees the emergence of nuclear families, where both husband and wife are part of the work force. Along with this economic independence come changes in the role of women within the family. They work for non-family organizations where they earn wages in exchange of their skills. This exchange is not the same as working on communal (or family) land and sharing the things they produce. There was no individual ownership and income division within the extended village family. The advantages of nuclear family for the migrant is mobility, privacy and independence. But the pressures imposed by this new family form may be overwhelming when hardships are encountered in

raising children, earning a living, etc. , and no extended family is available to provide support.

In traditional societies mobility is at a minimum; men are born into the positions in which they will die, and sons succeed their fathers. Status and prestige are assigned mainly on the basis of long established family connections. Authority is feared and respected. In urban societies people assign prestige more on the basis of education and technical skill rather than on grounds of traditional status, and respect for religion is broken down. In the Western world interpersonal competition, ambition, initiative, ability and rivalry are respected personal attributes. (In this regard I found it interesting to observe that among the migrant children I tested, the least self-opinionated children were found among the segregated group that had arrived recently. Their answers showed extreme deference to parental authority, God's will, etc.)

(1972)
Triandis^A has well summarized some of the changes attending migration in his own discussion of the phenomenon of social change. He writes:

With social change the individual is confronted with a more complex environment where norms of behavior, as defined by the individuals in the group, become less and less functional. The reason is that such norms are undifferentiated, undefined rules of behavior which are too general, [being] appropriate for less complex environments characterized by clear-cut dichotomies in social life. Social change imposes change in value orientations (Kluckhohn and Strodtbeck, 1961). Instead of depending on others for survival, they move into a milieu of relative affluence.

Therefore, they can . . . strive for individual achievement and self-actualization. Under these conditions their value system changes to fit the new social environment. The in-group norms which are meant to regulate and control the behavior of the individual changes as the individual moves into a larger, far more complex and organized social milieu. The context of the social milieu

for the individual is ever changing depending on the level of formality of the social interaction and the degree of affective involvement. . . .

When an individual moves from a lower to a higher complexity milieu, his social conduct ceases to be regulated by the in-group norms as strictly as it used to be in the small community. There, survival, security and social protection in general were secured by the individual through his in-group relations.

3.5.4 Education of Migrants in West Berlin. According to integration policies adopted by the German Federal government, foreign children and their parents have legal rights to welfare and social services, just like the German population. In Germany the educational system is not centralized. Every Lander (region) has its own policy, but in general every Lander has made school attendance compulsory for children. In Germany, nine years of full-time and three years of part-time vocational school is legally required for German children. In principal, this compulsory attendance also applies to the foreign children.

The adoption of the integration policy in German education in 1975 also recognizes the need for foreign children to be instructed in their mother tongue and national culture for those who one day would return back to their country. Such nationality-specific instruction is given by fully trained foreign teachers employed by the German schools. These classes are held after regular classes during weekdays or on Saturdays.

In December 1971, the KMK (Kulturministerkonferenz), the Lander Education Ministers' Standing Committee, adopted a detailed resolution on improving the education of foreign children (see Hufner, 1972:1-4). It urged that all children able to follow instruction in German should be attending classes in German schools. Their numbers should not exceed 25 per cent of

the students in any single class to ease the integration process. In order to allow foreign children to attend German-instructed classes, preparatory language classes were formed of about 15 children. These children joined classes in music, arts, physical education, and manual projects with other children. These one-year special classes prepared the child to follow regular German-language classes with the German children. The special classes were taught by a teacher of their own nationality in their mother tongue. At the end of the year, the children were placed in regular classes according to their age and academic performance (see, Castles and Kosack, 1973: Ch. 5; Metall, 1970, pp. 5-6).

Other recommendations of KMK were that where such special classes weren't available, additional instruction and assistance with homework should be provided for foreign children having language problems.

These special classes have their drawbacks. Even though they seem justified from an educational point of view, they pose a hidden danger of introducing segregation. In districts where the foreign population was heavily concentrated (e.g., Kreutzberg and Wedding) the number of German children attending school decreased because of the apprehensiveness of many German parents who were afraid that the educational level would go down in classes where there was a high percentage of foreign children. Special schools providing Turkish instruction were made available to those who preferred to continue their education in their own mother tongue.

Chapter 4
LANGUAGE AND OPERATIONAL THOUGHT
WITHIN THE PIAGETIAN FRAMEWORK: A SUMMARY

there is a strict correlation between operativity and language, but in which sense? There remains, moreover, the question of establishing whether it is a question of language action as such or of an influence of analysis exercises that learning involves and whether certain progress would not have been accomplished without this learning by the development of schemes in function of various activities." (emphasis added)

Piaget (1971:60)

In this chapter we review Piaget's theory as it is relevant to our research.¹ In the first section (4.1) of this chapter we summarize Piaget's theory of cognitive development introducing the key concepts in his theory. In the following section (4.2) we consider Piaget's position on the relationship between language and thought in general and cognitive development in particular, summarizing empirical research on linguistic and socio-interactional factors affecting cognitive performance. In section 4.3 we consider the cross-cultural evidence that has been collected to test Piaget's theory in various sociocultural millieux. Finally, we give an overview of the pilot study and the hypotheses we set out to test.

4.1 PIAGET'S THEORY OF COGNITIVE DEVELOPMENT

Piaget's theory is based on genetic epistemology which involves both the formation and structure of knowledge. Piaget has adopted a biological, structural and interactionalist approach to study the basic concepts and operations that underlie the acquisition of knowledge. He has taken the adaptation of the biological organism to its environment as the metaphor for his

¹ In developing the present summary we have relied heavily on reviews by Elliot and Donaldson (1982), Inhelder (1982), Qleron (1977), Sinclair de Zwart (1973, 1982), Versey (1974, 1980) Dasen and Heron (1980), Vuyk (1981), Nielson and Dockrell (1982).

theory. In Piaget's (1972) own words,

epistemology is the theory of valid knowledge, and even if this knowledge is never in a state and always forms a process, this process is essentially the passage from a lesser to a greater validity (p. 7-8).

Piaget explains the psychological attainment of knowledge and skills in terms of biological processes among which are the two basic functions of organization and adaptation of organisms to their changing environment.

4.1.1 Basic Assumptions of Piaget's Theory

Cognitive adaptations are the functional invariants of assimilation and accommodation. Piaget describes assimilation, in general, to mean incorporation into an existing system (Piaget, 1972:28). The compatibility of the object outside the subject's already existing schemes and structures is an important factor in assimilation, otherwise the object may go unnoticed or be ignored. If it is in the realm of assimilability than accommodation takes place which brings about a new organization incorporating the new elements into the ongoing system

every assimilatory scheme has to accommodate to the elements it assimilates, that is, to change a function of their characteristics, but without losing its continuity nor its former powers of assimilation. (Piaget, 1978)

In other words, the new object in the environment is signified (classified) by the subject through assimilation and the subject is enriched through accommodation.

As a result of assimilation and accommodation a state of equilibrium is established between these two invariant functions which works as a self-regulatory mechanism. This process is

responsible for keeping the organism in a balanced state, compensating for the effects of the outside world on the cognitive structures of the individual (Piaget, 1967, ch. 4). This notion plays a central role in the developmental theory of Piaget.

Structure. The underlying assumptions of Piaget's structuralism are that there is a pattern or organization for mental functioning, that this pattern (structure) can be discovered through orderly analysis, and that these patterns have a generality and cohesiveness that extends beyond a specific instance (structure d'ensemble). In general these structures refer to the form or pattern of cognitive content (Inhelder, 1982). Three strategies can be employed to study these structures: (1) specifying the activities under study; (2) examining the logical skills carefully for an underlying organization; and (3) drawing out coordinations between organizational factors that we have assumed (Overton, 1977, p. 66).

Probably the single most important element of Piaget's theory is the notion of structure (see Piaget, 1970). Structure is defined by Piaget as a system which is regulated by the laws of transformation and is conserved and enriched by the very interplay of its transformations (Piaget, 1970). Structures are not static but are subject to change; they grow as a function of adaptation and organization.

Structures are developed out of general coordinations of actions of the individual on the environment. They are formed through the process called equilibrium. When the individual runs

into new information which is not present in the structural system a state of disequilibrium is produced which in turn calls for cognitive structures to accommodate themselves to handle the new situation. This consequently brings about a new state of equilibrium which is supported by new and additional information, thus being more resistant than before. In cases where the individual already has the schemes (abilities to classify and organize the objects outside) he assimilates the objects into the system. In cases where the pre-existing schemes are not adequate, the individual has to accommodate his cognitive system by generating or modifying new schemes and structures to incorporate the external reality through "reflective abstraction."

Reflective abstraction refers to a two-fold process: one acting at a conscious level (thus "reflective") and the other involving reorganization and coordination of new abstractions with the already existing ones (Inhelder, 1982). Reflective action is the key distinction between concrete and formal operations.

There are three basic ideas that govern the action of structures: wholeness, transformation, and self-regulation (Piaget, 1970). They maintain characteristics of closure which means that the transformations within the structure do not go beyond the boundary of the system, but eventually lead to a substructure.

Scheme is a more specific concept than cognitive structure and has properties that are quite different than structures as follows:

- A scheme is a series of related cognitive content that is tightly knit elements which tend to trigger each other, e.g. grasping, reaching, sucking, etc. in the sensorimotor stages.
- At later stages of cognitive development schemes turn into abstract cognitive structures. They have the same characteristics as the structures, that is they control the expression of specific cognitive contents and allow functional invariants to be expressed.
- Schemes are mobile in nature and can be "stretched" to extend to various actions.

Schemes as Piaget notes, are spontaneously exercised where change and development are an issue. If schemes do not come into contact with new information, change does not take place. Therefore repetition of the schemes are important for hierarchical change and development. This functional reproductive property is the basis of circular reaction in cognitive development in infancy.

Organization is another concept borrowed from the biology of adaptation. Its general function is to maintain continuity and integration among the structures and substructures. Structures are the basic elements of organization. Without this organization all transformations would lead to incoherence and transmission would not be possible at all (Piaget, 1972).

For cognitive organization three characteristics are essential: the first being conservation (the necessary construction of invariants at all levels of development). A second characteristic of cognitive organization is a constant tendency towards differentiation and its complementary integration. Without such integrations where relationships are of fundamental importance, the experiences would be separate

elements not leading to a meaningful construct or categorization that gives order to the world outside. The third characteristic is its dynamic nature, that is, the ever changing content has to be integrated into the system by assimilation and accommodation.

4.1.2 Stages

The stages that Piaget proposes for his theory of cognitive development are based on the assumptions that we already have discussed. (These assumptions are not testable; they are taken as a given.) Cognitive structures are the key concept to the differentiation of stages.

Piaget sees the general process of cognitive development as being essentially qualitative. Therefore cognitive development is not a continuous process and cannot be measured quantitatively by precise means.

Piaget claims that we can infer the presence of structures by analysing the various cognitive contents specific to a given stage of development for each stage is characterized by a unique set of cognitive structures. Piaget (1960) posits five criteria for each of the stages:

- a. qualitative change in cognitive elements (structure)
- b. a culturally universal invariant sequence in the overall development
- c. inclusion of cognitive structures of each preceding stage in each subsequent stage (hierarchization principle; integration)
- d. involvement of restructuring and coordination. General integration of the structures of each stage characterizes

the final attainment of the stage (consolidation; structure d'ensemble principle).

- e. increasing stability and flexibility in the way new problems and objects are dealt with (equilibrium).

Piaget has proposed that there are four main stages (also called periods) that an individual goes through in his development. These stages change as a result of adaptation and organization and they are based on the notions of invariants (conservation) and reversible operations.

Sensorimotor period: This first stage does not elicit reversible action but the available actions are organized by schemes which later develop into reversible and invariant structures that shape acquired knowledge into organizations. Within this stage the concept of object constancy is developed.

Preoperational period: The second stage proposed by Piaget prepares the infant for the acquisition of language. This stage is characterized by increased internalization of actions repeated in the first stage. The concept of identity without the operation of reversibility or transitivity is developed. This stage is the beginning of the discovery of covariations which precede the concept of conservation.

Concrete operational period: This stage is the beginning of a particular form of logic which stems from objects themselves and the actions performed on them. The operations are comprised of conservation, classification, seriation, one-to-one correspondence. These operations, unlike the others in earlier stages, show properties of reversibility and can be described in

terms of a total system, called the "groupings." According to Versey (1974) the abstract notion of a grouping is "a set of elements and an operation obeying the properties of closure, associability, reversibility (inverse) and identity, together with the notion of least upper bound which allows the description of special identities (resorption and tautology)."

Versey (1974) describes the nine groupings proposed by Piaget (1942, 1949) as follows: four of the groupings are said to be related to classes and four to relations; the remaining grouping involves equalities. A major difference between the two main sets of groupings (classes and relations) is in the property of reversibility. Inversion is the reversibility of classes; it consist of negating a class or an inclusion. Reversibility in relations is attained by reciprocity which consists of eliminating a difference (Versey, 1974; see also Piaget, 1953:26; Brown and Desforges, 1979:76). The groupings relevant to the concrete operational stage are Groupings I, IV, V, and VIII; these groupings are described by Brown and Desforges (1979:76-81) as follows:

Grouping I: primary addition of classes. This grouping allows simple class inclusions and the construction of a hierarchy of classes, e.g., Tuna included in the class Fish, which, in turn, is included in the class Animal, etc.

Grouping IV: one-to-one multiplication of classes. This grouping permits the representation of relations such as those in genealogical trees, e.g., a family of brothers and their sons can be depicted by a family tree wherein the relationships between the brothers is symmetrical but the relation between fathers and sons is asymmetrical.

Grouping V: asymmetrical difference relations. This grouping permits seriations, i.e., a sequence of transitive asymmetrical relations. It requires the ability to assemble relationships that express differences.

Grouping VIII: one-to-one multiplication of relations.

This is similar to the multiplication of classes shown under Grouping IV, but it involves the multiplication of symmetrical and asymmetrical relations (rather than classes) in hierarchical classifications like family trees (e.g., relationships like father of, cousin of, etc.). For example, "If A is father of B, and B is a first cousin of C, then it must follow that A is father of the first cousin of C and hence the uncle of C."

These are first-order operations since they do not require the coordination of two forms of reversibility.

Formal Operations: The fourth stage proposed by Piaget is characterized by second degree operations which are hypothetical deductive. They differ from the first degree operations which involve objects directly (Versey, 1974; see also Inhelder and Piaget, 1958:254). The child generalizes the earlier operations of classification and relations into a combinatorial system which enables him to combine exhaustively objects with objects, classes with classes, factors with factors, propositions with propositions (Piaget and Inhelder, 1969:133). The formal operations require the coordination of the two reversibility rules (inversion and reciprocity) and therefore they are called second-order operations (Versey, 1974).

4.1.3 Methode Clinique

To test his theory of stages of cognitive development Piaget uses a unique method called the methode clinique. This method differs from the traditional experimental method in which a "treatment" is manipulated to determine its effects on behavior. In particular,

1. This method is based on observation and it is also used

as a manipulative agent to provoke certain responses in relation to a given task.

2. This method usually involves fewer subjects in the hypothesis testing, therefore it is open to criticism as to the reliability of its findings.
3. This method does not facilitate standardization since the procedures of the task depend on the subject's responses. The reliability of these observations and findings depend on the skills, perceptiveness and objectivity of the interviewer who has to be carefully trained so as not to mislead the subject.
4. This method is a conservative diagnostic procedure: the presence of a cognitive content is verified by administering several variations of a given problem-solving task.

Piaget has insisted on using this method in spite of the criticisms because he believes the study of cognitive development is too complex to be studied by other standardized research methods. In the methode clinique, open-ended probing questions can produce spontaneous answers that allow the researcher to trace the understanding of operational responses so that mental actions can be observed.

Horizontal decalage involves quantitative improvements in both the structure and content of cognition that occur during the

course of each stage. Acquisition of new structures, that is vertical decalage, takes place only between stages. The contents characteristic of one stage are unstable during development, producing different performances by the child. When the instabilities disappear from the cognitive contents characteristic of a given stage, the necessary operations have been attained.

4.1.4 Conservation

Conservation is the understanding that quantitative relationships between objects remain invariant under certain transformations that produce irrelevant perceptual differences. Piaget (1954) emphasizes the necessity of conservation for all logical operations.

Conservation is the chief indicator of concrete-operational intelligence; it requires the learning of a "group" of first-order quantitative invariants involved in the conservation of number, substance, weight, length, distance. The three criteria for inferring conservation are:

Reversibility: There is as much B as in A, because A could be derived from B.

Identity: Nothing has been added or taken away; same stuff; etc. This criterion can only be used as evidence of conservation when the other arguments are applied (Piaget and Inhelder, 1969:158).

Multiplying relations and compensation (reversibility based on compensation): B is longer than A but it is also not as fat as A.

Piaget has concluded from his studies that children go through three phases in developing conservation skills.

- o. Non-conservation: the child denies conservation and focuses on irrelevant perceptual aspects of the task.
- o. Transition: the child may give conservation responses under certain conditions but not in other situations.
- o. Conservation: the child judges the operation to be invariant and gives an appropriate explanation to support his judgement.

Piaget's notion of conservation has been criticized by several researchers, as noted by Vuyk (1980, p. 152). Toulmin (1971) emphasizes that,

the notion of conservation has itself changed substantially in the course of intellectual history, and even today people from different backgrounds will understand it in very different ways.

Bryant (1974) points out differences between young and older children in attitudes concerning number conservation:

young children have two conflicting rules and do not yet know which one to use. Older children have learned somehow an alternative absolute code and find out how irrelevant the length cue is, thus getting rid of their various inconsistencies.

As Vuyk (1980) notes, some experiments ignore sociocultural factors that may affect performance (e.g., materials used, settings, the role of the experimenter etc.) and also overlook some of the ambiguities in the required linguistic expressions. (We will be describing some empirical studies of these issues later in this chapter.)

4.1.5 Rationale for the Tasks Used to Study Logico-Arithmetic Operations

Since our research involves children at the concrete operational stage we chose four sets of tasks that are indicative of concrete operational thought. The four sets of tasks used in the study and their related groupings are:

1. First set: conservation of liquid, solid (continuous and discontinuous) and weight. The underlying theoretical basis for all these tasks is the structure of the bi-univocal multiplication of relations--Grouping VIII.

2. Second set: multiple classification matrices (grouping IV). Multiple classification is a counterpart of multiple seriation. It involves children's ability to categorize a collection of objects simultaneously according to two properties by constructing a matrix (Brainerd, 1978, p. 184). Conservation of number is analogous to this task because of the one-to-one correspondence used in classification. Piaget believes that multiple classification entails not only that the picture (item) of two classes are equally filled but also that each specific picture (item) in one class corresponds to a unique picture (term, item) in the other class and vice versa (Brainerd, 1978).

3. Third set: seriation, one-to-one correspondence. Numbers are both cardinal and ordinal, since "it is of the nature of number to be both a system of classes and

of symmetrical relations blended into one operational whole" (Piaget, Inhelder, 1969:104). Cardinality entails one-to-one correspondence and has links with the conservation of quantity by way of discontinuous quantity. Conservation of quantity precedes other conservations because of the nature of the materials used (separate solid units). Ordinality is based on seriation and is a relational operation. Ordinal numbers are concerned with collections of objects that have been ordered according to some asymmetrical-transitive relation. Cardinal numbers are on the other hand, concerned with how many elements different classes contain. In the number tasks children are expected to coordinate length and density attributes to arrive at solutions.

4. Fourth set: geometrical concepts. The tasks used involve the relations of distance and time.

4.2 ROLE OF LANGUAGE IN COGNITIVE DEVELOPMENT

Piaget considers the creation of knowledge to be due not to language, but to abstractions (of different kinds and levels) from actions performed and at later stages from their coordinations (Piaget, 1970, 1975, 1977). These abstractions constitute objects, and furthermore the abstractions from objects and their invariances constitute concepts.

This interactive dynamic organization of the world is

complemented by the interactively competent unit of thought, called structure. Piaget's epistemological theory depends on these structures which are developed in terms of the mathematical models of group theory. Piaget has indicated that cognitive structure probably is the single most important concept in his system (Piaget, 1970, cited in Brainerd, 1978).

Because of the nature of our research, we will now try to summarize Piaget's view of the the role of language as a constructive factor in the development of thought.

4.2.1 Language and Thought

Piaget in his early years proposed that there was a causal relation between language and thought (see, for example, his 1924 book entitled Le Langage et la Pensee chez l'enfant). Later, he changed his position, stating that "language is a necessary but not a sufficient condition for the construction of logical operations" (Piaget, 1964, 113). This position derived from the assumption that thought developed from activity and the structures were rooted in action (Piaget, 1964, p. 112). Having made this distinction, he then adds:

the more the structures of thought are refined, the more necessary is language for their elaboration (p. 113).

The mediation of language becomes necessary: "because without the system for symbolic expression, which is language, operations would remain as successive actions and never be integrated into simultaneous systems" (p. 113). Additionally,

They would remain individual and thus not benefit from the regulation which results from the exchange and cooperation among the individuals" (p. 113).

Piaget sees the relationship of language and thought as a "circular interaction," such that each one depends reciprocally upon the other "in a unified and continually interactive manner" (Piaget, 1964, 113; and see also Oleron, 1977, ch. 5; Ferreiro, 1971).

In the following pages we will briefly consider Piaget's views on two aspects of language: the structural aspects of language and the function of language.

4.2.2 Structural Aspects on Language

Piaget having clearly stated that thought develops independently of language, posits several arguments to back up his position.

First, he argues that language is only one form of collective symbolism among other individual symbolic activities (e.g., making believe, mental imagery, deferred imitation -- in absence of the person imitated, etc.) Therefore, language itself is not a sufficient condition to elicit thought.

Secondly, Piaget finds the origins of thought in the child's actions and the patterns (schemes) of the pre-verbal sensorimotor period. He has derived this conclusion from his observations of his two children in their early years of life. Piaget maintains that:

Thinking, in the sense of operations and concepts that make it possible to absorb information, to fit it into a meaningful framework and to go beyond it towards new discoveries and inventions, has its roots in activity, not in language (Piaget, 1963, p. 54; quoted in Sinclair de Zwart, 1982).

Sinclair de Zwart also notes that in this context Piaget uses the word "language" as the "first words" and utterances of the child

that belong to the mother tongue and that have a more or less stable meaning to the child.

Thirdly, Piaget claims that even though a child may acquire a natural language with all its lexical and syntactical structures, he still may not be in a position to grasp class inclusion, interaction, conditions and consequences (Piaget, 1963:58). The studies of Inhelder and Piaget (1959) show that such operations are not exercised until later. Piaget argues that despite the fact that the ordinary use of language provides a representation of class relationships, such knowledge is only assimilated when the child becomes capable of additive and multiplicative operations which are coordinated actions that have been assimilated and that show reversible and temporal properties unlike the preoperational concrete manipulations.

To summarize, language, says Piaget (1963, p. 58), may help the assimilation process, but it neither creates nor directly transmits logical structures (Sinclair de Zwart, 1982). Even though Piaget stresses the importance of language for the elaboration of structure he argues against a constructive role of language in thought processes. He says that complex structures such as lattices and combinatorials cannot be formulated in natural language and they do not even seem to be implicit in language itself.

But these whole structures go beyond the subject's language and could not even be designed using only available language (Piaget, 1963, p. 59).

Thus from what we can extract from his work, it appears that for Piaget language in its universal linguistic structural aspects cannot be said to have an influence on thought.

4.2.3 Functional Aspects of Language

The second part of this section on the role of language briefly summarizes the functional aspects of language. Since Piaget attributes a necessary rather than a sufficient role to language in relation to thought he suggests that the functions of language rather than its lexical and grammatical structures may have a constructive influence on thought. The two basic functions of language are representation and communication.

4.2.3a Representational Function. According to Piaget, representation has its roots in imitation and begins as recognition, memory, and imitation in the first weeks of life. During the second year of life imitation develops into a more specific capacity allowing the child to evoke persons, objects and events in their absence. This capacity is called the symbolic function by Piaget, and it is said to play an essential role in cognitive development.

Piaget sees this interdependence of the symbolic function and cognitive development as a dialectical relationship. In his own words,

the semiotic (symbolic) function makes thought possible by providing it with an unlimited field of applications in contrast with the restricted boundaries of sensorimotor intelligence and of perception, but it develops only under the direction and with the help of thought or representative intelligence" (Piaget, 1966, p. 72).

He concludes that the representational function of language is neither a sufficient nor a necessary condition to make thought possible.

4.2.3b Studies with Deaf Children. Piaget cites studies

with deaf children who have no use or knowledge of a natural language as evidence for his position. Piaget (1963) notes the experiments carried out by Borelli (1956) and Oleron and Herren (1961) showing that deaf children are capable of constructing the essential operations, i.e., seriations and classifications -- although their development is somewhat retarded when compared to hearing children. In particular, using conservation of liquid, mass, and weight tasks, Oleron and Herren (1961) found a lag of about six years in the functioning of deaf children. Furth (1964, 1966) observed a similar delay (five years) with the conservation of liquid tasks, but a lesser delay (about two years) with conservation of weight.

It is likely that this discrepancy in time lags was due to the way the tasks were administered. Furth asked his subjects to hold the pieces of clay in their hands and judge whether or not they weighed the same, whereas Oleron and Herren had subjects use a diagram of a scale in solving the problem.

In two tasks involving transitivity, Youniss and Furth (1965, 1966) found that deaf children performed as well as hearing children of the same age. They interpreted these findings as indicating that transitivity is acquired independently of language, although deaf children were found to make more errors in the transitive situations than the hearing subjects. Classification studies done by Heider and Heider (1940) and Oleron (1951) found no significant differences between deaf and hearing children; both groups progressed with age.

Caouette (1964, 1974) also gave a series of conservation and seriation tasks to deaf and hearing children eight to fifteen

years old. In all cases, developmental lag existed in deaf subjects. Oleron (1951) used a three-attribute multiple classification (by object, color, and number) with deaf children. He found that deaf children and adolescents were much less successful on these tasks than their hearing peers (Pettifor, 1968). For each classification a different principle was employed and the subject had to make a shift between principles and go beyond what was immediately perceivable in order to organize his responses. Since Piaget emphasizes the importance of multiple classifications as an indicator of operational thought, these findings have been interpreted to mean that the deaf show a significant deficit in the attainment of operational functioning at the point where language takes over in establishing the hierarchies and mental differentiations needed in solving these tasks.

Taken overall, the studies with deaf children are in line with Piaget's position that thought is not dependent on language (see Oleron, 1977). The deaf in spite of their lack of representational verbal medium, develop basic mental structures albeit with a time lag. Since Piaget is not concerned with the age at which operational levels are attained, but rather with the invariance of sequences, time lags do not present a serious problem for Piaget's theory.

Where little development lag was observed it has been suggested that dominance of perceptual cues in problem solving bridge the gap between operational and nonoperational performance. Thus, deaf children have no difficulty when a seriation problem involves immediately present stimuli. So,

Borelli (1956), for example, reports relatively little difference between deaf and hearing children on simple seriation. It has been suggested that this result occurs because seriation can be completely based on perception since the nature of the relationship among the elements and even the order is observable. Even though mastery of the problem reflects operational development, the task can be completed perceptually because of the support provided by figural representation (Piaget and Inhelder, 1969).

One might say the same thing for classification tasks. Simple classification involves combining and separating elements on the basis of perceived similarities; it does not require mental operations, per se. Complex problems involving double or triple classifications can also be solved by perceptual means which may not involve operational processes (Piaget and Inhelder, 1969).

Piaget further discriminates between operational and non-operational functioning by reference to the ability to assimilate reciprocal relationships and particularly, by the ability to extend classes and subordinate subclasses (class inclusion). These types of problems cannot be solved without the intervention of language (Piaget and Inhelder, 1969).

The research findings with deaf children show that deaf children succeed as well as the hearing on the first set of tasks we have mentioned above--those that are made up of perceptual components. Their success on the operational tasks, however, lags behind that of hearing children. What we may generalize from these studies is that both thought and language may derive

from the general organization of actions within the framework of a developmental theory of cognitive activity (Ferreiro, 1971, p. 12).

Language and Operational Thought. These differences in attainment of certain operational levels have provoked some researchers to try to specify in detail how language contributes to the solution of mental problems. Oleron (1977), for example, analyzes language from a functional point of view. He argues that language has five important functions. First, language establishes distance between the perceiver and the object perceived. It enables the person to analyze the situation and hypothesize about consequences of possible actions upon that situation. Second language implies an active and constructive behavior at both ends of a communication (understanding and speaking) since it is social in nature. The meanings of messages must be coded, recognized and constructed as the subject utilizes speech, even to himself. Third, language provides a coding system which facilitates the solution of a problem. A verbal code may be used in various situations but it reflects a common principle. Fourth, language is not an entity by itself but reflects the product of acquired habits and cultural input that entails both specific knowledge and the disposition to employ this knowledge under appropriate conditions. And finally, according to Oleron, language provides elaborations and potential organizational schemes which are not as constrained by individual experience. It introduces both similarities and differences from the relatively novel systems developed by the individual, and thus expands and clarifies the individual's perception and

behavior.

Oleron (1977) suggests a structural and operational model for language development that is superimposed on the development of thought. Schemes which emerge in the first months of life enable one to adapt to the properties of objects. Piaget and Inhelder (1968) focus upon the organizational functions of these elements that comprise an early but incomplete logic.

It is possible to draw a parallel between the development of language and thought. Structure, in Piaget's theory, is rooted in action and in attempts to identify organizations. From a structural point of view the assimilatory forms of action schemes (which are functional, generalizing, and recognatory) can be applied to words and further to verbal organizations whether perceived or produced. Thus the word becomes the repeater, coordinator, identifier once the subject comes into contact with the signifier.

From a functional point of view (focusing upon the development of verbal skills after the attainment of operational thought), the subject applies a scheme (action or word) to objects. The child's behavior initially involves activity and perception and with maturity language makes the individual relatively independent of these and provides access to structures determined by internal rules. Furthermore, the operations of assimilation and accommodation may be extrapolated to language behavior which no doubt is a source of experience and activity since language by its nature is a social phenomenon.

Sinclair de Zwart (1973) strongly advocates a theory that derives language from cognitive structure. She has concluded

from her findings that the major constituents of syntax and the operations involved in the transformational process show strong parallels to the syntax of action (scheme) described by Piaget within the sensorimotor period, e.g., joining sentences together develops from an ability to join two activities in a play.

Greenfield et al. (1972) and Dodson and Greenfield (1975) have also studied the structural relations between cognitive and linguistic development. They found a sequence of strategies in nesting cups between 11 and 36 months of age. Greenfield relates the successive cognitive structures elaborated in the nesting of each cup within the next larger cup to parallel strategies that occur in the acquisition of language.

Kiel (1979) notes that there is a tendency to relate knowledge about nature to the development of classification skills. Several studies produce controversial results. Harris (1975), Anderson (1975), and Mansfield (1977) concluded that the child organizes his semantic knowledge in a manner that reflect superordinate-subordinate relations. The authors claim that in children this ability appears as young as five years old. Even though the studies were severely criticized for their methodology, there still seems to be strong indications of hierarchical organization. Rosch et al. (1976) and Markman and Ciebert (1976) have observed that pre-schoolers show considerable skills on classification tasks. They conclude that "in the appropriate domain where classes are highly concrete and internally structured rather than arbitrary, children appear to have some knowledge of class inclusion relations" (Kiel, 1979, p. 136).

Greenfield and Schnieder (1977) investigated the development of children's ability to copy a physical tree structure -- a mobile made out of plastic straws. The results showed that the ability to construct hierarchical structures starts at the age of three and develops with age. An important aspect of this study is that while children frequently make mistakes, they rarely made the mistake of constructing a structure facing downwards, from age five onwards. Their observations led the authors to conclude that "both action and language development are constrained by the development of a general ability to deal with hierarchical tree structures" (Greenfield and Schnieder, 1977; quoted in Kiel, 1979, p. 139).

Kiel (1979) argues that more research is needed to clarify the relation between truth-functional and meaning hierarchies and classification skills. He suggests on the basis of his own research that even though the structural properties of language and other skills may seem to be superficially similar, they stem from different underlying cognitive operations. For example, the results of his own work suggests, he argues, that children's ability to perceive lexical and structural ambiguity in language does not correlate with the ability to detect ambiguities in pictorial displays, and these two abilities show quite different developmental patterns.

4.2.4 The Function of Language in Social Interaction and Communication

Piaget finds it difficult to separate language and thought as entities and says (1954, p. 52) "the question is like asking whether it's the chicken that makes the egg or the egg that makes

the chicken, since all human behavior is at the same time social and individual."

He further stresses the importance of social interaction regarding the justification of symbolic functions.

Apart from social interaction no reason for the transition from action to pure representation can be found . . . representation and detachment from one's own action are underpinned by adaptation to others and social cooperation. (p. 322)

He describes the interrelationship between social interaction and thought as, "as soon as language appears, the socialization of thought can be witnessed in the elaboration of concepts, of relations and rules, that is to say, a structural development [takes place]."

Indeed, it is due to cooperation with others that the human mind comes to make observational judgements according to Piaget. The recording of facts implies a presentation or an exchange and has no meaning in itself for the individual's own activity (Piaget, 19-- , p. 316). Piaget notes the importance of discussion and dialogue in interpersonal exchanges and attributes to these actions a constructive role in mental operations (see also Bruner on importance of dialogue). He argues that knowledge cannot be passed on by language, per se; phenomenological knowledge is something we must construct through social interactions.

As we shall see in the following discussions, the communicative aspect of language plays an important role in the cognitive domain.

4.2.5 Role of Language in Methode Clinique

Piaget has a special involvement with language as a means of social interaction; this involvement arises from his use of the

method clinique to study thought processes. Language is important in the clinical method both in the instructions given and the questions asked by the experimenter, and also in the fact that the child gives verbal answers and justifications. Attention thus needs to be paid to the role of language in Piaget's methodology.

An important concern in this regard involves the receptive linguistic abilities of the children under study. Since Piaget believes that thought develops prior to language, children will only be able to cope with language that reflects the cognitive structures that are already established (Elliot and Donaldson, 1982). While there is little risk that we will overestimate the child's cognitive development by using the methode clinique, the possibility of underestimating the children's development is worrisome. Several authors have suggested that linguistic development may not follow the line of cognitive development or may be impaired from normal development as is the case with the deaf, aphasics, or children migrating to foreign linguistic environments. In those cases, the natural or first language may no longer be functional in social interaction, and the second language may not be a reliable nor valid means to study mental development (see, for example, Dasen, 1977:35).

In cross cultural studies the language used in presenting the tasks and interviewing of children with diverse languages may have strong effects on their performance. Dasen (1977) points out that a child being tested in his second language rather than his mother tongue may appear unable to conserve due to his inadequate competence in his second language. (It should be

noted that language problems may also arise when children are tested in their native language by an experimenter who is not a native-speaker of that language. Administering the procedures, interpreting the responses, and reporting of the nuances of children's thought processes can be seriously deficient in such circumstances.)

Cole, Gay and Sharp (1969) studying the ease of learning to use size as a feature for classification observed that in Kpelle (the language spoken in Liberia) an equivalent of "smaller than" is rarely used whereas an equivalent of "bigger than" was common.

Piaget emphasizes two points with regard to productive language and cognitive development. First, the appearance of certain words (e.g. more, less, all, etc.) in children's language is not an indication of comparable mental operations. Piaget also interprets misuses of these words as indicative of underdeveloped logical ability ("verbal confusion . . . is always a sign of logical confusion;" Piaget, 1928, p. 77). Secondly, what Piaget takes as evidence for the attainment of mental operations is the clear and precise use of language which seems to process the operations involved to arrive at a solution. Elliot and Donaldson (1982) interpret Piaget's position in the following words:

When expressive language is free of confusion and when it accurately expresses the understanding of a phenomenon which has already been demonstrated in the child's actions, it represents a higher intellectual attainment than the non-verbal attainment of an operation because it indicates a level of conscious realization of knowledge that was previously unconscious (p. 160)

Since Piaget contends that language is necessary to convey certain operations he has always required an explanation

following the child's judgement to insure the stability of the mental structures he was studying. This procedure may cause a portion of seemingly operational children to be classified as pre-operational.

Wheldall and Poborca (1979), for example, designed a non-verbal task and trained 6-7 year old children to press one button when presented with two jars with equal amounts of water. Once they could make this discrimination correctly, they were asked to respond when one of the two quantities judged equal was poured into a different jar. The children succeeded on this task significantly more often than in the traditional three-alternative questioning situation, e.g., are they the same or is one more or less? Siegel and Hodgins (1982) note, however, that if one uses less verbal, rather than non-verbal tasks, the success rate shown by children is still higher (see also Siegel, 1978).

The studies testing children for their understanding and use of relational terms (more, less) also show the ambiguous interpretations given to these words by the child (Weiner, 1974, Kavanaugh, 1976). Other research has shown details of language use to be crucially important in "success" and "failure" on various conservation tasks. Goodnow (1973), for example, observed that question form influences the justification of conservation responses. For class-inclusion tasks use of a phrase or single additional word for the superordinate class makes the solution easier (Donaldson, 1978, Markman, 1973).

Inadequate linguistic comprehension thus appears to be a common problem. There are several studies showing that young

children tend to act upon ambiguous messages or instructions rather than seek further information (Cosgrove and Patterson, 1977; Ironsmith and Whitehurst, 1978). Siegal and Goldstein (1969) suggest that children may use a recency strategy in which the child selects the last alternative presented in the statement when their understanding is not sufficiently clear.

4.2.6 Social Interactional Factors

Besides the linguistic variables there are also non-linguistic factors that need to be taken into account in the evaluation of Piaget's studies. The type of transformations performed, the materials used, and also the interpretation of the experimenter's behavior and the sequence and format of verbal questioning poses an important problem in assessing the cognitive development of the child.

The effects of repeated questions in number conservation tasks where two rows of five marbles each, equal in length are presented to the child were investigated by Rose and Blank (1974). They hypothesized that asking the same question before and after the transformation suggests that the change made by the experimenter is important, therefore from the child's point of view the new situation calls for a different answer.

To test this assumption, Rose and Blank tested children in the standard conservation task and in another task without asking for a judgement of initial equality. They found that children made fewer errors in "one question" tasks. These children when subsequently presented with the standard task situation, did better than the children who received the standard task to begin

with.

This study was replicated and expanded by Neilson, Dockrell and McKechnie (1983) in a series of three experiments. They found that repetition of the conservation question itself did not lead to a change of judgement in the child. In a second experiment they found that the one-judgement procedure was only influential on number conservation tasks. And lastly, they found that when nursery school children were tested, the one-judgement procedure did not show any facilitatory effect at all. Samuel and Bryant (1984) further replicated the one-question experiment with 6 year olds. Their results indicated that the one-judgement version was easier; children who failed with the standard procedure succeeded with the one-question version.

McGarrigle and Donaldson, (1974/1975) also note that experimentally manipulated conservation situations may represent a dilemma for the child. The child may interpret the non-linguistic behavior of the experimenter as cues to some intention on the experimenter's part to divert the child's attention to other dimensions of the task. (For example, in number conservation tasks, changing the length of one row may lead the child to concentrate on that aspect of the problem.) These authors tried to control for the resultant misinterpretation of transformation in the task performance. They introduced a teddy bear to act as an agent who "accidentally" transformed the rows. The children were found to give more correct responses in this new situation. It was assumed that the children saw the mischievous transformation made by the teddy bear as incidental to the problem rather than as an attempt by the experimenter to

threaten and test their initial understanding. The significance of this modified task is that the child is helped to ignore the social cues and to concentrate on the basic operations.

Dockrell, Campbell and Neilson (1980) replicated the study of McGarrigle and Donaldson (1975) with two separate experiments: one employing the traditional intentional transformation (IT) and the other the accidental transformations (AT) caused by a "naughty" teddy bear. Half of the subjects in each group received four AT and the other four IT problems. The results confirmed the original study. In the second experiment the authors set out to prove McGarrigle and Donaldson's procedures were not valid as a conservation task. They argued that McGarrigle and Donaldson used only four counters which may provoke pseudo-conservation, facilitating perceptual solutions. (To test this assumption Dockrell et al. tested children using both four and seven counters.) Their second criticism of McGarrigle and Donaldson's study was that they posed three different conservation questions, thus giving the child grounds to guess. They conclude that even though a distractor may bring about more conservation responses it nevertheless does not generalize to other tasks. The results of their second experiment suggest that Rose and Blank, 1974 may have emphasized an important factor that what affects the child is asking the question twice rather than the intentional transformation. The naughty teddy bear justifies the experimenter's repeating the question thus compensates for the ambiguity of the intent of such a repetition of the question. The best way to study the logical thinking of the child in such task situations is to obtain

justifications for his judgements, which may have other communicative flaws, as discussed later.

Light et al. (1979) note that the principle underlying McGarrigle and Donaldson's argument may be generalized to other tasks. Children were given a standard and a modified version of conservation of discontinuous quantity task with beakers containing pasta shells. Two children placed the shells in two beakers of similar dimension. In the modified task a transformation was called for because one of the beakers was chipped and said to be unsafe for use. Therefore the "defective" beaker was replaced with a different container of a larger size. This "incidental" transformation did not seem to alter the initial conservation judgements. Light et al. (1979) report that the success rates in the standard and modified versions of task presentation were 5 percent and 70 percent respectively.

Similarly, Murray and Tyler (1978) indicate that the type of transformation executed makes a difference in children's responses. They found that certain types of transformation produce a shift in judgement (Dockrell, Campbell, and Neilson (1980)).

These modified procedures suggest that the young child may be more competent than Piaget may think he is. But the counter argument also can be presented due to the assumption that these structures are not fully or definitively established in the child since he falls prey to the perceptual variables introduced to test out the stability of his understanding of these operations.

In defense of the judgement-only procedure Elliot and Donaldson (1982) note that the use of language is quite different

for a child and an adult. Adults may use language as a means to convey a message separate from its particular context, whereas a child cannot manipulate or process language apart from its immediate context and thus falls prey to the features of the setting.

Lloyd, 1975 has observed that children elicited different response patterns depending on whether their interlocutor was an adult or a dim teddy bear. They were found to elaborate their justification of their responses to a given task in a more cognitively complex trying manner when the other party was not an adult. Since the teddy bear is perceived as having less knowledge of skills in general, the child takes the responsibility to instruct him.

Blank (1974) observed that justifications in traditional Piagetian conservation tasks were found to vary as a function of the experimental situation. Where both parties were in view of the task, justification seems redundant and perhaps absurd. Where the child had to explain about the task to someone who had not followed the task his justification became more complex (see Nielson and Dockrell, 1982).

Rose (1973) also raises a very important point in relation to young children's response set, that is, their tendency to say "yes" to questions they are asked. We do encounter such responses in non-Western cultures where adults in authority positions are expected to be answered in the affirmative, a behavior imposed by sociocultural values (Ghuman, 1982). In a memorable test of the adult pressures that may exist in the testing situation, Hughes and Grieve (1980) found that children

would offer explanations of any kind in response to nonsensical questions posed by the experimenter; e.g., "Is milk bigger than water?" (An example of the replies they received is: "Milk is bigger 'cos it's got colour.") Such a demonstration indicates that the need to say something when questioned by an adult experimenter can be quite strong.

The administration of the Piagetian tasks in other cultures presents many further difficulties similar to the problems we have discussed above. These are considered in the following section.

4.3 CROSS CULTURAL RESEARCH ON COGNITIVE DEVELOPMENT

Piaget (1966) inaugurated the International Journal of Psychology with a treatise on the necessity and significance of comparative research in which he drew attention to the potential cultural and linguistic relativity of his own findings:

En un mot la psychologie que nous elaborons en nos milieux, caraterises par une certaine culture, une certaine langue, etc., demeure essentiellement conjecturale, tant qu'on n'a pas fourni le materiel comparatif necessaire a titre de controle (p. 12)

4.3.1 Empirical Evidence

Such cross cultural evidence has begun to accumulate in recent years, supplementing the early work of Hyde (1959) in Aden, Goodnow (1962) in Hong Kong, and Price-Williams (1961) in Nigeria. The studies of Bovet (1974) in Algeria, Laurendeau and Pinard (1963, 1970) in Canada and Martinique, Za'rour (1971a, 1971b) in Lebanon, Lloyd (1971) among the Yoruba, Mohseni (1966) in Iran, Okonji (1971a, 1971b) in Uganda, and Oppen (1977) in Demetriou (1982) with Greek population in Greece and Australia

Thailand, delineate the general effects of sociocultural variations upon the processes of cognitive development elaborated by Piaget. Typical of these researches is the finding of Marcel Goldschmidt and his associates (1973) that children in seven nations (Australia, New Zealand, England, USA, Uganda, Holland and Poland) passed through the stages of cognitive development in the same sequence which Piaget describes for Swiss children, although the rate of development varied from society to society.

Although past cross-cultural research (reviewed by Dasen, 1972, 1977, 1978; Modgil, 1976; Dasen and Heron, 1980) has considered the possibility that children in other cultures may differ from the youth of Geneva in the age of attainment or rate of their cognitive development, few studies have identified any factors which could account for the differences which have been found. As Dasen concluded in his summary of this research, the data provided by almost all of these studies is descriptive; a great deal of further research is needed to link variations in development to specific cultural factors. Factors isolated to date include: schooling (Goodnow, 1962), socioeconomic status (Lloyd, 1971), and urban residence (Peluffo, 1967).

Applying Berry's (1976) notion of ecocultural relevance, Dasen investigated the development of concrete operational skills in Australian Aborigine children, West African farm children (Ebrie), and in Eskimo children. Berry had predicted that spatial skills would be developed most rapidly in ecosystems and cultures that depended on a nomadic, hunting and gathering economy. Spatial skills are particularly key to survival in such societies; they are less crucial in sedentary, agricultural

societies. Based on Berry's notions, it was predicted that spatial concepts would emerge first in the Eskimo and last in the West African farm children. Dasen (1975) also hypothesized that agricultural peoples would have more need of conservation of quantity, weight, and volume, because food is often stored away or exchanged in markets -- and hence the invariance of these properties under transformation should be of ecocultural significance. Thus Dasen predicted a reverse ordering of results for these conservation tasks. The results generally support the investigators' predictions: children from hunting and gathering societies (Eskimo and to a lesser extent Aborigines) develop spatial skills before the children of agricultural societies. But, children in agricultural societies develop the notions of conservation of quantity, weight, and volume before children from hunting and gathering societies. A somewhat similar finding is reported by Price-Williams, Gordon and Ramirez (1969) in a study of the sons of potters in Mexico. They found that the son's of potters performed better on conservation tasks than the boys from a matched comparison group whose fathers worked in other jobs. (The comparison groups was matched to be equivalent in education and age to group of potters' sons.) P. Williams et al. suggest that the potters' sons had greater experience in manipulating and judging the sizes and capacities, etc. of pots and similar objects and so developed the notions of conservation at an earlier age.

There has been a growing awareness of the situational or contextual factors that influence whether a cross-cultural study uncovers evidence of a particular cognitive skill. Cole et al

(1971:233), for example, argue that

Cultural differences in cognition reside more in the situations to which particular cognitive processes are applied than in the existence of a process in one cultural group and its absence in another.

Besides the work of Cole and his collaborators with the Kpelle, there have been a few other demonstrations of the importance of such contextual factors. Carraher et al. (1985), for example, recently published an interesting demonstration of the impact of contextual factors. They found that young Brazilian (mean age = 11 years) children from very poor families were able to perform rather complex arithmetic calculations when the problems were posed in a natural context (e.g., One coconut is Cr\$35. I'd like to buy 10 coconuts. How much will they cost?). However, when they were presented with formal problems that required similar calculations (e.g., $35 \times 10 = ?$) they were unable to solve the problems. Carraher et al. (1985:25) conclude from their findings that "Real-life and world problems may provide the 'daily human sense' which will guide children to find a correct solution intuitively without requiring an extra step -- namely, the translation of word problems into algebraic expressions. Indeed, Carraher et al. suggest that their work is in accord with the claims of Donaldson (1978) that very young children (e.g., age 5) are able to give responses that show decentration when they understand the problems and the intent of the experimenter. This is an explicit challenge to the notion of an inherent egocentrism to the thought of very young children.

Dasen (1974) in working with Aboriginal children in Australia found that the children they tested sometimes were sufficiently intimidated by the tester's suggestions in considering an

alternative -- as is common in the clinical method (e.g., would any other one fit as well -- this often led the child to change their answers even though they were operational. They observed that the children were: "not used to expressing and maintaining [their] opinion," and so counter suggestions were taken as criticism requiring that the child change his answer. Similarly in his work with Punjabi children, Ghuman (1978) found a similar behavioural pattern with Punjabi children. He quotes one child as explaining his reason for changing his response by saying: "If I were correct in the first instance I would not have been asked to explain reasons for my response."

Greenfield (1966) found in her study of liquid conservation among unschooled bush Wolof children in Senegal that the children attributed to her some magical powers. They elicited non-conservation judgements with explanation as such: There is more in this glass, because you poured it. When another group of bush unschooled children were tested, this time doing the pouring themselves, the proportion of conservers doubled and action-magic responses disappeared.

Such attitudes clearly introduce considerable difficulties in making valid cross-cultural comparisons.

During the 1970's both cross-cultural researchers and Piaget himself seem to have refined their views about the values of cross-cultural research on cognitive development. Ghuman (1982), for example, reflects the view that the data from cross-cultural research will not influence the fundamental theoretical issues for the Piagetians, nonetheless it can help further our understanding of the factors that affect development. In his words:

. . . cross-cultural research is unlikely to resolve the basic issues in the theory, such as unity of stages (structure d'ensemble), sequential development of cognitive structures, and clarification of key concepts such as equilibration. However, such a [cross-cultural] research strategy can illuminate the importance of sociocultural and linguistic factors to cognitive development by selecting societies with contrasting value systems and can pinpoint the role of specific experience on the acquisition of cognitive operations. Furthermore, research across cultures can demonstrate in a dramatic way the significance of Western style of living (within traditional contexts) to the development of logical thinking processes.

Moreover, Piaget, himself, seemed to move during the 1970's in the direction of allowing for a greater potential effect of sociocultural factors on children's cognitive development. In 1972, for example, he wrote:

The formation and completion of cognitive structures imply a whole series of exchanges and a stimulating environment; the formation of operations always requires a favourable environment for 'co-operation'[I]n principle all normal individuals are capable of reaching the level of formal structures on the condition that the social environment and acquired experience provide the subject with the cognitive nourishment and intellectual stimulation necessary for such a construction. (Piaget, 1972:7)

So far, the findings have verified the sequence of the stages. The variations in the age of attainment of conservation, the rate of development, and horizontal decalages have been attributed to sociocultural and ecological factors, but the mechanism of their influence on cognitive development have not been specified. Since 1972, Dasen (1980) notes that a number of studies have further complicated the overall picture. In the following section, we will review these findings.

4.3.2 The Question of Structure d'ensemble.

In a series of studies conducted between 1969 and 1976,

Alastair Heron and his colleagues have reported results which they see as reflecting the effect of cultural "values" or "cognitive ambience" on the sequence in which children in different cultures master the various operations characteristics of the concrete operations stage. Heron and Simonsson (1969) tested 200 children in Zambia on reasoning tasks of an induction and matrices type and on a weight conservation task (using a miming procedure developed by Furth, 1966). They found that conservation performance did not show a linear increase with age but rather at age 11 the developmental curve seemed to reach a maximum of 55 percent passing. Little improvement was shown in weight conservation after that age. Moreover, Heron and Simonsson (1969) found a very low correlation between the performance of these children on the weight conservation and reasoning performance.

To explain their findings, Heron and Simonsson (1969, p. 29) introduced the notion of "cognitive ambience." They defined this as "the total pattern of implicit cognitively-relevant cultural values, communicated through linguistic and other behaviour by adults and older children." The difference between the results found in Zambia and those commonly found in Geneva and other Western societies was posited to be due to a difference in cognitive ambience.

In a subsequent study Heron and Dowell (1973) tested children aged ten to sixteen in Papua. Here too they administered weight conservation and a matrix-type reasoning task of 15 items presented in ascending order of difficulty, and they again found that there was little relationship between performance on the

conservation task and performance on matrix-type reasoning tasks. Indeed, Heron and Dowell (1973) found that several nonconservers among their Papuan samples solved all fifteen of the multiple classification tasks they were presented with.

Heron and Dowell (1974) then expanded the scope of their work using a larger variety of conservation tasks and multiple classification tasks used by Inhelder and Piaget (1964) and modified by deLacey (1970). They administered these tasks to a sample of Serbo-Croatian immigrants to Australia. The children ranged in age from nine to twelve and had been resident in Australia from 3 to 24 months. All children were tested in Serbo-Croatian. Here again they found atypical results. Overall, the results showed that children were about two years behind the Genevan children when compared on several aspects of concrete-operational performance. However, the authors also found that one-third of the non-conservers in their study could solve seven of the eight multiple classification matrices. The authors report that among nonconservers they found no association between multiple classification performance and sex, urban versus rural residence, recent versus early arrival in Australia, Macedonian versus Serbian ethnicity, or even age. However, taking the sample as a whole, there was a significant association between multiple classification performance and length of residence in Australia. Those children who had lived in Australia 12 to 24 months did significantly better on the multiple classification problems than children who had lived in Australia less than 12 months.

In a retesting of this same immigrant group two years later,

Heron, Gardner and Grieve (1976) used a control group of 49 native Australian children matched on age and father's occupation. They found that the Yugoslav children lagged behind their Australian peers on conservation, but they equalled the natives on multiple classification. Finally, it should be noted that in a study whose main purpose was to study the effects of training on operational development, Heron and Kroeger (1975) also reported that they found no association between conservation performance and classification performance. The subjects in this training experiment were 109 children of Yugoslav migrant workers in West Berlin aged nine to thirteen (median 11.6) who had been resident in West Berlin for a period ranging from six months to five years. (The main finding of the study concerning training was that there was no training effect with conservation of weight, liquid and volume, but significant training effects on multiple classification performance in a post-test nine weeks after training.)

In an overview of this research Dasen and Heron (1980) attribute the divergence in the sequencing of development of conservation and classification performance to cultural values and assumedly the resultant cognitive ambience. In particular, they suggest that the sequencing of the acquisition of various types of skills within the concrete operations stage is a function of the values different cultures place on different sorts of skills. In their words:

the structure d'ensemble posited for the Genevan child does not necessarily hold elsewhere; two concepts that develop congruently in the average Genevan child may develop at very different rates in another culture, if one of them is more highly valued . . . in that other culture. (Dasen and Heron, 1980, p. 327)

In considering the findings of Heron and his colleagues, we would suggest that it is important to recognize that in each of these studies all (or a substantial portion) of his subjects were bilingual to some extent -- either by virtue of their migrant status (Yugoslav immigrants in Berlin and Australia) or their being schooled in a second language (schoolchildren in Papua and Zambia). It is thus possible -- and we would argue that it is indeed likely -- that bilingualism (not some unspecified divergence in cultural values or cognitive ambience) is the key factor in explaining these results. As noted at length in Chapter 2, there is a body of evidence which suggest that one of the effects of learning a second lexicon and the related transformational rules, is to increase cognitive flexibility and the ability to abstract from concrete situations, and to apply logical rules. These are many of the same skills required in solving the multiple classification problems.

4.3.3 The Role of Literacy in Cognitive Development

Several investigators have studied the effects of schooling on cognitive performance. Generally, the results indicate a positive relationship, although, to our knowledge, there has been no study that has carefully controlled for factors such as bilingualism, use of middle versus lower class linguistic codes, etc.

Lloyd (1971) used a classification task with Nigerian children aged three to eight. The children were from two groups: (1) school children from elite homes with educated mothers, and

(2) unschooled children from traditional homes with uneducated mothers. She reported that performance improved with age and that the elite school children performed better than the traditional unschooled children.

Cole, Gay, Glick, and Sharp (1971) suggest that literacy may be particularly important in recall and categorization. They report that subjects from the Vai tribe who were literate in Vai but had little formal schooling recalled and clustered more than Vai subjects who were not literate in the Vai script. The authors observe that people with little schooling produce semantic categorization and high levels of performance only when the organizational structure is explicit. This fact led the authors to conclude that unschooled children have not learned to engage in activities that provide structuring for material that is not semantically and functionally related (see also Luria, 1976).

Rogoff (1980) reviews several studies that show the influence of literacy and schooling on classification performance (Irwin and McLaughlin, 1970; Sharp, Cole, and Lave, 1979; Greenfield and Child, 1972; Glick, 1975). These authors have observed increased taxonomic responses (socks and shoes), superordinate terms (apple-fruit), increased ability to shift dimensions in reclassifying, and increased ability to generalize rules across situations.

These findings prompt us to take a closer look at schooling and what it entails.

Education seems to be the variable most clearly related to help differentiate between objects in a test situation and also

facilitating generating rules for classification. This may be due to the literacy involved in education. Dervida (1978) describes the nature of literacy.

Inscription alone . . . has the power to arouse speech from its slumber as sign. By enregistering speech, inscription has as its essential objective . . . the emancipation of meaning. (p. 12)

In other words the literate person comes to notice that speech is not merely a means for expressing meanings and intentions but at the same time has a structure and integrity (meaning) in its own right.

To treat language as an object is a consequence of learning and using a metalanguage for referring to linguistic forms. Our concern with the metalanguage is that the speaker acquires an analytic skill in deciphering the levels of structure and gaining awareness over the details of language in its structural and functional level.

Scribner and Cole (1981) suggest that the effect schooling may have on the cognitive development, in part, is due to the types of questions raised in school: Why do you say that? How do you know? How can you tell? etc.

The development of language tends to increase the independence of concepts from their context. Written language encourages abstraction.

In literate cultures the participants come "to speak the written language" as Greenfield has put it (1968). Cole and Scribner (1972) have pointed out to the intrinsic anti-authority implication of abstract formulations. When such discourse takes place in traditional societies where the truth value of propositions is not dissociated from the authority of the speaker

ambiguity, mistrust and antithetical feelings arise on the word-bound speakers of that milieu.

Basil Bernstein (1971) emphasizes the codes of behavior employed by different socio-economic classes to maintain control and group solidarity. He proposes three modes of control: the imperative (explicit orders) positional (depending on the situation) and personal (depending on the particular skills and characteristics of the child) corresponding with certain types of discourse varying in qualitative competence: linguistic competence, communicative competence, and analytic competence (see Bruner and Peterson, 19--, "Language as an instrument of Thought").

Bernstein (1971, p. 147-148) differentiates two socialization patterns involving collective and individual value-orientations. (These patterns may help explain the differences in cognitive performance found between schooled versus unschooled and Western versus non-Western children.) Bernstein describes two types of communication evolving as a result of these socialization patterns.

An elaborated code will arise wherever the culture or sub-culture emphasizes the 'I' over the 'we'. It will arise wherever the intent of the other person cannot be taken for granted. In as much as the intent of the other person cannot be taken for granted, then speakers are forced to elaborate their meanings and make them both explicit and specific . . . In terms of what is transmitted verbally, an elaborated code encourages the speaker to focus upon the experience of others, as different from his own. In the case of a restricted code, what is transmitted verbally usually refers to the other person in terms of a common group or status membership. What is said here epitomizes the social structure and its basis of shared assumptions. Thus restricted codes could be considered status or positional codes whereas elaborated codes are orientated to persons. An elaborated code, in principle, presupposes a sharp boundary or gap between self and others which is crossed through the creation of speech which specifically

fits a differentiated 'other'. In this sense, an elaborated code is oriented towards a person rather than a social category or status. In the case of a restricted code, the boundary or gap is between sharers and non-sharers of the code. In this sense a restricted code is positional or status NOT person oriented. It presupposes a generalized rather than a differentiated other.

Bruner (1974) makes a similar point in regard to socialization patterns in different cultures and their effect on the cognitive development of children.

Differences in cognitive styles derive as much from such socialization processes as they do from features inherent in a specific language the child is exposed to (see Slobin, 1979). Moreover, when two languages are involved in cognitive assessment of the child, the issue becomes more complex. The potential positive effects of bilingualism were discussed in Chapter 2. Under optimal conditions, with literacy in two languages, bilingualism may exert a beneficial effect on cognitive development. Been-Zeev (1977) summarizes these potential effects as follows:

Positive effects of bilingualism involve metalinguistic types of understanding such as sentence ambiguity, ability to mark and substitute the basic word units of a sentence, as well as the basic units of a nonverbal matrix system; and flexibility in reorganizing or reclassifying the units of a nonverbal system according to different points of view.

In other words we might say that balanced bilingualism and literacy in two languages in Piaget's terms operates as a reflected abstraction on general mental operations separating the child further from the immediacy and concreteness of objects and actions in much the same way that literacy, per se, does for monolinguals.

4.3.4 Language and Cross-Cultural Research. Although

theories of the functional interrelation of language and thought have a long history (e.g., Whorf, Sapir, Vygotsky, Luria), cross-cultural researchers have paid little attention to the manner in which structural differences in languages might account for variations in the development of cognitive skills.

Slobin (1973, 1976) has distinguished two aspects of language acquisition: one a universal sequence for the emergence of certain fundamental ideas (semantic intentions) and the second a more variable ordering involving the child's mastery of the linguistic forms required to express these ideas (syntactic structures). According to Slobin's (1973) cognitive prerequisites hypothesis, cognitive development is the "pacesetter" for language acquisition, while linguistic complexity determines the time needed for complete mastery. In describing the variability across languages constraining children's expression, Slobin draws upon his studies of Serbo-Croatian, Turkish and English-speaking children. He notes that the notions of actions and objects of action coded via case endings and/or word order involve different levels of difficulty in the various languages. He writes, for example, that Turkish has an agglutinative³ inflectional morphology that is "a joy to

³Agglutinative systems derive or inflect words by putting together constituent parts, each of which has a definite meaning. As an example of the agglutinative strategy of construction consider the one-word Turkish sentence: Onlardanmis. It is built as a single word from the third-personal pronoun "o" which is made plural and third person by adding "-lar", it is then given the ablative case ending "-dan", and finally the verb suffix is appended in the singular past/ascriptive tense "-mis", yielding onlardanmis whose literal translation is: he is said to be from them. (This is more adequately translated as: He is said to be one of them.)

descriptive linguists . . . and to the Turkish child as well" who masters the system by age two (Slobin, 1975, p. 7; cited in Bowerman, 1980, p. 130). From a very early age, Slobin found that Turkish children relied on case endings never used word order strategies to decipher what was subject and object in a statement. In contrast the inflectional system of Serbo-Croatian is quite complex, and subject to all sorts of irregularities and exceptions. Case endings in Serbo Croatian vary not only by gender and number, but also by animacy and the phonological shape of the stem word. Slobin found that Yugoslav children go through a drawn out period of learning this system and do not fully master it until age five. Moreover, the Serbo-Croatian speaking child tends to use a rather rigid word order (not imposed by the grammar) as an aid to comprehension.

Piaget (1974:303) has emphasized the importance of studying particular languages, writing that:

In so far as cognitive processes can vary from one culture to another, it is obvious that one ought to consider this group of factors which is distinctive from the former (i.e., biological). To start with, one could look at the various languages which are likely to have more or less influence, if not on the operations themselves, at least on the detail of the conceptualizations (e.g., content of classifications, relations).

An exception to the general case is the work of Sinclair de Zwart (1967), who has presented evidence that children who conserve use different linguistic forms than children who do not conserve. Adapting the notions of "scalar" and "vector" words from the linguist Bull (1963), Sinclair de Zwart observed that most French and English children designated as "conservers" made use of vectors (e.g., more and less), while "non-conservers"

relied on ordinary scalars (e.g., much and little) which could be coordinated to express comparisons, for example,

This is bigger (using a vector);
This is big and that is small (using coordinated scalars).

These findings, which have been replicated in a longitudinal study by Versey (1974), have interesting implications for the study of cognitive development in cultures whose languages do not have linguistic structures parallel to the English and French comparative forms. This part of Sinclair de Zwart's evidence parallels findings in a later study by Beilin and Lust (1975) who found that there was a correlation between mastery of the operator "or" in English and operational performance on a task involving the simultaneous classification of objects on two dimensions.

In addition to noting the correlation, Sinclair de Zwart (1967) also attempted to train some nonconservers to use vectors. Even though after training these children were successful in using vectors, Sinclair de Zwart found that their success rate was only 10 percent on the conservation tasks. This result suggests that language training alone is not adequate to produce operational development.

This research led Bloom (1981:79) to suggest that Sinclair de Zwart may have been too hasty in dismissing the possibility that the words themselves might still have played a crucial role in operational performance. He argues that if one views the vector words as "the linguistic labels of the very schema used to solve these tasks, it seems reasonable to suppose that the words may have played some role in guiding and even shaping the development

of these schemas. . . .and that the child might make use of these words . . . as a means of calling to and holding in mind the schemas they name"

This is an interesting notion, but it probably ignores some of the problems with Sinclair de Zwart's data. While Sinclair de Zwart's research was useful in demonstrating the association between cognitive and linguistic development (as well as the fact that linguistic training was inadequate to induce operational thought), her study has been criticized by several researchers. The major shortcoming that has been pointed out is the inevitable confounding of age with both language and cognitive development and linguistic development. (Her analysis of the correlation did not control for age.) Since maturation produces both cognitive development and the use of more sophisticated language, it could be argued that Sinclair de Zwart's finding of an association between these two domains was lacking in theoretical importance. Indeed, Moore and Harris (1977:134) dismiss Sinclair de Zwart's finding for just this reason. They write:

Sinclair de Zwart does not provide enough data to permit a definitive analysis, but it is quite possible that the overall positive correlation she observes is mediated by age, and thus would not constitute evidence of a unidirectional dependency. A demonstration that both language skills and operative functioning improve with age is uninteresting.

Oleron (1977:155-156) makes a similar point arguing that the evidence shows that both the language and the cognitive measures are indices of maturity and hence should be correlated, but this does not allow one to interpret the results "as if the nature and extent of the operational thought's effect on language had been

demonstrated" (or vice versa).

Despite such concerns, it has been observed by Siegel (1978) and Beilin (1976) that Piaget during the early 1970's began to revise his position on the interrelation of language and thought. Siegel (1978:148) describes this shift as being most evident in Piaget's preface to a monograph by Ferreiro (1971). In this preface, Piaget suggests two alternative views of the relationship of language and cognitive development: (1) development of cognitive operations are the motor for progress in linguistic development, or (2) there might be parallel development in language and cognitive operations, i.e., "decoding linguistic structure and solving various cognitive tasks are parallel problems to which the child brings epistemological strategies (Siegel, 1978:148). Siegel notes that Piaget by 1971 had come to prefer this second position, and thus his discussions of primacy and dependency in the relationship of language and cognitive development began to give way to a language of "correlation" between development in the two spheres.

Discussing Sinclair de Zwart's (1967) study, Piaget (1971, p. 60) concludes;

Hence there is a strict correlation between operativity and language, but in which sense? There remains, moreover, the question of establishing whether it is a question of language action as such or of an influence of analysis exercises that learning involves and whether certain progress would not have been accomplished without this learning by the development of schemes in function of various activities.

4.3.5 Research with Turkish Speakers. Piaget (1966) in noting the significance of cross-cultural research drew attention to the need to extend these studies beyond the European language families,

On voit alors d'emblée le très grand intérêt qu'il y aurait à multiplier des expériences de cette sorte en fonction de langues diverses. Sinclair a trouvé les mêmes résultats en français et en anglais. Mais il reste à recourir à des langues bien différentes. En turc, par exemple, il n'existe qu'un seul vecteur, qui correspond à notre terme "encore"; pour dire "plus" on dira "encore beaucoup" et pour dire "moins", "encore peu". (p. 12, underlining added).

In noting this divergence in linguistic structure between Turkish and French modes of comparison, Piaget suggests the unique importance of work with Turkish populations. Dasen's (1972, 1977, and 1978) reviews of cross-cultural Piagetian research includes no study carried out with a population speaking a Turkic language. The only studies of which we are aware are the investigation of seriation by Professor Semin in Istanbul (cited in Piaget, 1952) and the language acquisition studies conducted by Slobin and his coworkers. (The studies by Slobin were restricted to language acquisition, they did not gather data on other aspects of cognitive development.)

Although Piaget was quite correct in his observation that the structure of the comparative in Turkish is very different from the French comparative, his explanation was somewhat incomplete and imprecise. It is important that we describe in greater detail the relevant aspects of Turkish grammar.

First, although the translation of "daha" as "encore" is consistent with some, particularly Ottoman sources (e.g., Barbier de Meynard, 1881), it does leave much to be desired. Its translation might better and more simply be rendered as the vector sign ("plus" = "more") which is the first translation given in Delibasi's (1944) and Hony's (1967) dictionaries of

contemporary Turkish.

Secondly, in contrasting the formation of vectors in Turkish and French, Piaget oversimplifies the Turkish case, and thereby fails to convey just how different the two structures are. Specifically, while the simple comparison expressed in English by,

English: This is more.

is correctly and uniquely rendered by use of the vector sign "daha" together with the adjective "cok" (much, many), i.e.,

Turkish: Bu daha cok.

Literal: This (is) more much.

the "daha" is not required when the object of the comparison is stated. In this case the scalar (adjective) may stand alone, for example,

English: This is more than that.

Turkish: Bu ondan cok.

OR Bu ondan daha cok.

Literal: This (is) much than that.

OR This (is) more much than that.

Thus, in the case of two explicitly stated objects, a Turkish-speaker may communicate their comparison by using a scalar adjective alone. The use of "daha" in such cases is optional (cf. Nemeth, 1916, no. 53; Godel, 1945, p. 66; Lewis, 1967, pp. 54-55; Gencan, 1971, no. 382). This pattern is consistent for all adjectives; thus for "expensive" (pahali) we have:

SIMPLE: English: This is more expensive.
 Turkish: Bu daha pahali
 Literal: This (is) more expensive.

COMPARISON OF LINGUISTIC STRUCTURE OF COMPARISONS IN ENGLISH AND TURKISH

Q U A N T I T Y	Type of Comparison	Structure in English	English Example	Structure in Turkish	Turkish Example
	Description -no comparison	Scalar adjective alone	This is much	Scalar adjective alone	Bu cok.
	Simple comparison (object absent)	Vector sign alone	This is more	Vector sign and scalar adjective	Bu ondan cok.
	Coordinated comparison (object present)	Vector sign alone	This is more than that	Scalar adjective alone OR ^a Vector sign and scalar adjective	Bu ondan cok. OR ^a Bu ondan daha cok.
Q U A L I T Y	Description -no comparison	Scalar adjective alone	This is beautiful	Scalar adjective alone	Bu guzel.
	Simple comparison (object absent)	Vector sign alone	This is more beautiful	Vector sign and scalar adjective	Bu daha guzel.
	Coordinated comparison (object present)	Vector sign alone	This is more beautiful than that	Scalar adjective alone OR ^a Vector sign and scalar adjective	Bu ondan guzel. OR ^a Bu ondan daha guzel.

NOTE: For simplicity, we omit from the table the class of English vector-adjectives (bigger, etc.). This aspect of the English comparative is not paralleled in the Romance languages, although a similar duality does occur in Greek. This divergence has been the subject of a study by Sinclair de Zwart, who concentrated her attention on the three uses of the vector sign "plus" in French (i.e., as vector sign for qualities, as a comparative of "beaucoup", and lastly to express time as in "je n'en ai plus").

a Forms are interchangeable and equally correct.

COORDINATED: English: This is more expensive than that.
 Turkish: Bu ondan pahali.
 OR Bu ondan daha pahali.
 Literal: This (is) expensive than that.
 OR This (is) more expensive than that.

Table 4.1 summarizes the structure of the comparative in Turkish and contrasts it with English. Readers will note that in English a morphologically distinct vector (more) is both the comparative for quantity (scalar = "much"), and it, or its analog (-er), invariably must appear in all comparisons of quality. However, in Turkish the scalar alone can suffice for comparisons, and it must appear even in the comparison of quantities. Thus, the linguistic divergences involved in the comparative study of Turkish and non-Turkish speaking populations are even greater than those set out by Piaget.

So readers will not be misled, two points deserve clarification: (1) the simple comparative outlined above is a grammatically acceptable form which is frequently employed. There is some tendency (which we cannot quantify at this point) for educated speakers to consider the simpler form (Bu ondan cok) incorrect or "peasant-like"; (2) the form "Bu daha cok" should not be understood as the English "This is much more", which would be expressed as "Bu cok daha cok."

In this regard it is interesting to note that the Turkish parallel to the "-er" suffix of English ("-rak", "-rek") disappeared from common usages during the Ottoman period, although it survives today in a number of Anatolian usages (e.g., "yegrek" = "daha iyi": better), and in many other Turkic

languages spoken in the Soviet Union (see Menges, 1968; and Nemeth, 1916.)

Aim of Pilot Study. Because of the linguistic idiosyncracies of the Turkish language, the pilot study was able to provide theoretically interesting data (in addition to its primary purpose of testing the translations of our testing procedures).

In particular we hypothesized that there might be:

- differences between the structure of cognitive development (i.e., the sequence in which different skills were learned) between children speaking Turkish and children speaking other languages;
- differences in the way in which mastery of the vector forms was associated with operational development between children speaking Turkish and children speaking other languages;

The pilot study tested these hypotheses using matched samples of Cypriot children: some of whom spoke Turkish as a first language and some who spoke Greek. (All of the children were bilingual with English as their second language.) In addition, a sample of monolingual English children attending the same schools was tested. The following chapter describes in detail the methods and results of this pilot study.

Chapter 5

PILOT STUDY OF LANGUAGE AND COGNITIVE DEVELOPMENT WITH ENGLISH MONOLINGUALS, GREEK-ENGLISH AND TURKISH-ENGLISH BILINGUALS

The pilot study exploited a unique opportunity for the controlled investigation of the effect of linguistic factors upon cognitive development. This opportunity arose from the presence in London of a group of Cypriot immigrant children who come from equivalent social backgrounds. Greek-speaking Cypriots in London have a social status which is roughly equivalent to the Turkish Cypriots; both groups are migrants who have been resident in Britain for equal periods of time and who share the same neighborhoods and school. The two groups differed, however, in their native languages: Greek or Turkish. Since Greek structures the comparative in a manner similar to English, these samples provided the possibility of a quasi-experimental study in which language structure could be considered an independent variable (i.e., a treatment condition) and in which a monolingual English group is available for further comparative analysis. Besides its methodological goals, the present study of these populations was designed to facilitate:

- 1) an analysis of the latent structure of the skills tapped by conservation, seriation, and multiple classification tasks, in order to test the assumption that the structure of operational development is invariant across languages;

- 2) and secondly, an extension of Sinclair de Zwart's analysis to the Greek and Turkish cases.

5.1 METHOD OF PILOT STUDY

5.1.1 Subjects

A sample of children ($N = 110$; 47 percent male) was drawn from among the four to eleven year old pupils in two junior and two infant schools in North London. These schools contained approximately equal numbers of Turkish and Greek Cypriot children (10 to 15 percent of population), a larger number of working class English children, and smaller numbers of Indian, Pakistani, Italian, and African students.

Samples of Greek ($N = 40$) and Turkish ($N = 37$) children were randomly drawn from the population of four to eleven year olds. Only children speaking fluent Greek (G) or Turkish (T) and who reported this to be the normal language in their homes were included in these samples. The English (E) sample was restricted to children aged six to eleven due to widespread absences in the infants schools at the end of the term. All children in the English sample came from monolingual homes.

To test the social similarity of these samples, the children were asked how many brothers and sisters they had, and what type of work their fathers did. Children in all language groups reported a median of two siblings, and their fathers were mainly employed in skilled manual and lower grade non-manual occupations. The English fathers, however, did tend to work in slightly more skilled occupations. Coding these data into the seven-point Hall-Jones (1950) classification of occupations, we found a 0.7 unit difference between Cypriot and English fathers [mean level = 5.5 (T), 5.2 (G), 4.6 (E)]. Standardized reading test scores were available for 64 children in the sample. These

scores showed both the Turkish and Greek Cypriot samples to be lagging 13 months behind the national reading norms for Britain. This result is not unusual for bilingual children from working class homes. Scores for the English sample were, as expected, significantly higher than those of the immigrant sample; however, these scores also were somewhat lower than the national average.

5.1.2 Tasks and Tests of Linguistic and Cognitive Development

The tests of linguistic and cognitive development used in the pilot study included:

1. Language pretests.
2. Conservation of number, weight, continuous and discontinuous substance, and three tests of conservation of (liquid) quantity.
3. Seriation.
4. Multiple classification.

(These tasks and the procedures used for administering and scoring in this pilot project are described in detail in the Appendix.)

All testing was done in the children's native language by the author who speaks native Greek and Turkish, and fluent English. To familiarize herself with any idiosyncrasies in the Cypriot dialects spoken by the Turkish and Greek children, the author resided for three months in the residential district from which the sample was drawn. The major peculiarities which she noted were distinctive accents and idioms in both languages and the occasional interjection of English phrases into conversations that were otherwise exclusively Greek (or Turkish).

5.1.3 Testing Procedures

Testing was done individually at the children's schools, and was divided into two sessions of approximately 40 minutes each. All conservation and seriation tasks were given in a single session and the order of tasks within this session was randomized across subjects. Multiple classification tasks were given in a fixed order at a separate session. The order of presentation of the two testing sessions was balanced across the study. All testing was tape recorded.

5.2 RESULTS OF PILOT STUDY

5.2.1 Performance on Conservation and Classification Tasks

The most striking result revealed by an analysis of the children's performance on the various tasks was the suggestion that there are two relatively independent areas of operational development: conservation and multiple classification. This result was evident even in a rather crude comparison. Summing results across the seven conservation problems, we found that the English children gave operational solutions to significantly more ($t=2.07$, $df=68$, $p<.05$) of these problems than the Turkish children. The performance of the Greek children was midway between that of the Turkish and English groups. This result, in itself, should startle no one, although it is unique in that all of the children were of similar socioeconomic status and were tested in their native languages. The surprising result was obtained when we performed a similar analysis of the children's performance on the eight multiple classification matrices. Here

we found an exact reversal of the previous pattern: the Turkish children solved significantly more classification problems than the English children ($t=2.05$, $df=68$, $p<.05$), and again the Greek children fell midway between the two extremes. Identical results were obtained when analyses of covariance were employed across the three groups, with the effects of age being held constant.

This reversal of performances is representative of the findings on each individual task. Table 5.1 presents a breakdown by age and language group of the children's performance, and the results of covariance analyses for each task (controlling for age). An examination of Table 5.1 confirms the results of the gross analysis. With only one exception, we find that all significant differences on conservation tasks show the Turkish children to perform most poorly, and on the multiple classification matrices, for them to perform most competently. We also note that the poor performance of the Turkish children on the conservation tasks cannot be attributed to a deficiency in their ability to seriate since all the Turkish children aged six or above demonstrated competency in this area.

These results are disquieting since they preclude any simplistic notion of a general deficit in operational development, and thus they bring into question the unity of the concrete operational stage itself. Heron and Dowel (1974) have encountered a similar phenomenon in their work with Serbo-Croatian immigrants in Australia. A series of analyses which parallel those of Heron and Dowel have been performed on the present data, and the results substantially support their conclusions. In particular, classifying as "operational" any

TABLE 5.1: Passing Rates on Piagetian Tasks for English Monolinguals, and Turkish and Greek Cypriot Bilinguals

Task	Age	LANGUAGE				COVARIANCE ANALYSIS ^a	
		Turkish (N=37)	Greek (N=40)	English (N=33)	Total (N=110)	sig. level	order
Conservation of quantity (discontinuous)	4-5	0	0	---	0		
	6-7	(5)	(3)	---	(8)		
	8-9	75	27	30	41		
	10-11	(8)	(11)	(10)	(29)	n.s.	---
Conservation of number	4-5	13	0	---	13		
	6-7	13	24	60	97		
	8-9	38	83	67	188	<.02	G/E/T
	10-11	36	83	67	186		
Conservation of substance (plasticene)	4-5	0	0	---	0		
	6-7	13	0	---	13		
	8-9	23	77	67	167	<.005	E/G/T
	10-11	33	77	67	177		
Conservation of weight (plasticene)	4-5	0	0	---	0		
	6-7	13	0	---	13		
	8-9	23	31	36	90	n.s.	---
	10-11	33	39	67	140		
Conservation of quantity (continuous/liquid 1)	4-5	20	0	---	20		
	6-7	13	44	30	87		
	8-9	31	77	37	145	<.01	G/E/T
	10-11	64	92	89	245		
Conservation of quantity (continuous/liquid 2)	4-5	0	0	---	0		
	6-7	13	9	20	42		
	8-9	15	39	36	90	n.s.	---
	10-11	18	31	33	82		
Sum & division of continuous quantity	4-5	40	0	---	40		
	6-7	38	9	30	77		
	8-9	69	83	36	188	n.s.	---
	10-11	100	100	67	267		
Seriation	4-5	0	0	---	0		
	6-7	100	55	80	235		
	8-9	100	93	79	272	n.s.	---
	10-11	100	100	90	290		
Matrix 2	4-5	60	100	---	75		
	6-7	100	100	80	280		
	8-9	92	100	71	263	<.005	G/T/E
	10-11	100	100	89	289		
Matrix 3	4-5	40	67	---	107		
	6-7	44	44	30	118		
	8-9	92	77	50	219	<.05	T/G/E
	10-11	100	77	78	255		
Matrix 4	4-5	40	0	---	40		
	6-7	20	64	40	124		
	8-9	85	77	50	212	n.s.	---
	10-11	91	77	89	257		
Matrix 5	4-5	0	67	---	67		
	6-7	13	18	20	51		
	8-9	15	44	36	95	n.s.	---
	10-11	73	62	78	213		
Matrix 6	4-5	20	33	---	53		
	6-7	23	0	10	33		
	8-9	48	39	33	120	<.05	T/G/E
	10-11	73	34	33	140		
Matrix 7	4-5	20	67	---	87		
	6-7	38	27	20	85		
	8-9	89	46	43	178	n.s.	---
	10-11	82	77	67	226		
Matrix 8	4-5	0	67	---	67		
	6-7	30	36	30	96		
	8-9	46	31	36	113	<.15	T/G/E
	10-11	91	83	89	263		
Matrix 9	4-5	20	0	---	20		
	6-7	30	44	20	94		
	8-9	34	31	36	101	<.05	T/G/E
	10-11	91	31	30	152		

Note: Sample sizes for the table are given in parentheses with the entries for the first task; because of extremely small sample sizes, results for the 4-5 year olds should be interpreted with extreme caution.

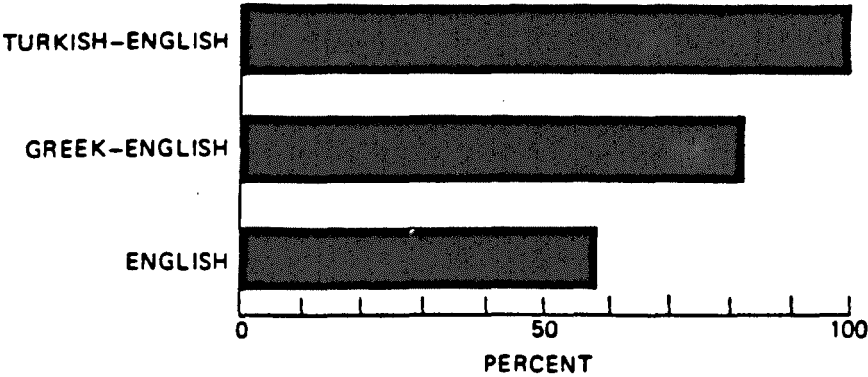
^a Covariance analysis tests the significance of differences between the three language groups, after first adjusting for the effects of age on performance. For all tests, the degrees of freedom were 2/106.

child who succeeded at five of the problems in either set, it was found that all the Turkish children who were "operational" on the conservation tasks were also "operational" on the multiple classification tasks, whereas seven of the seventeen English children who were "conservers" did not succeed at the multiple classification tasks ($p < .05$ by Fisher exact test). Conversely, of the 24 Turkish children who were operational in the classification tasks, only 33 percent exhibited the appropriate range of conservation skills, while the comparable figure for the English was 72 percent ($p < .05$ by the Fisher exact test). Here again the Greek children fell midway between the two extremes delimited by the Turkish and English cases: 52 percent of the Greek children who were "operational" on the classification tasks also evidenced operational thought on five or more conservation problems. (Figure 5.1 displays the results of this analysis.)

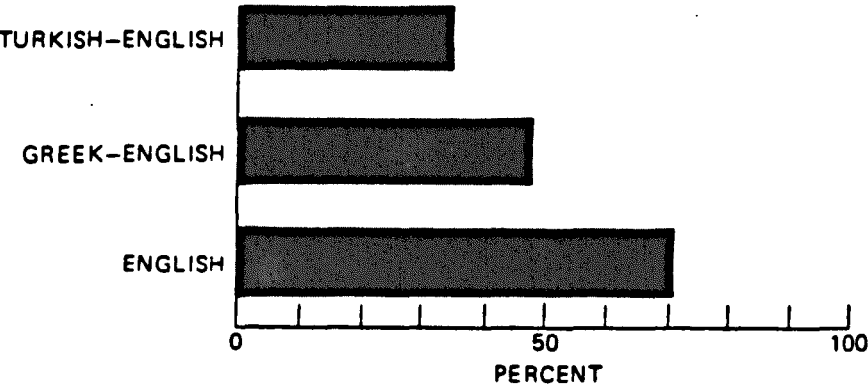
Since this evidence supports the hypothesis that language structure may exert a determining influence upon the course of cognitive development, we have undertaken a closer analysis of the underlying structure of development.

5.2.2 Searching for Developmental Structure

5.2.2.a Unidimensional Approach. A basic aim for the pilot study was the exploration of the latent structure of cognitive development during the concrete operational stage, so as to permit an examination of the influence of language. One approach to this question is to begin by assuming that the 16 Piagetian tasks may show an invariant ordering of "difficulty" which reflects a developmental sequence such as that in which all



Percent "Fully Operational" on Conservation Tasks, Who Are also "Fully Operational" on Multiple Classification Tasks.



Percent "Fully Operational" on Multiple Classification Tasks, Who Are also "Fully Operational" on Conservation Tasks.

FIGURE 5.1: Performance on Conservation Tasks of Children Classified as Operational on Multiple Classification Tasks

children learn to walk by first crawling. The Guttman scaling procedure (see Torgerson, 1958) provides a method for such analyses. By using this technique to obtain independent orderings of task difficulty for the Greek, Turkish and English samples, we can test the hypothesis that the order of difficulty for the 16 tasks is constant across languages.

Performing this analysis we found substantial inconsistency across groups in the ordering of task difficulty, with the least consistency existing between the rankings for the Turkish and English groups ($\tau = +0.3$, ns). Since the Turkish and English groups differ in both their (1) immigrant status and attendant bilingualism, and (2) the manner in which their native languages structure comparisons, this result might be interpreted as evidence of the influence of either, or both, factors. This problem may be resolved by reference to the orderings obtained for the Greek and English groups, who differ in migrant status but share a common structure in their native languages for the expression of comparisons. Since the similarity ($\tau = +0.6$, $p < .001$) between task rankings for these two groups (who differ on only one dimension) is almost double that between the Turkish and English samples (who differ on both dimensions) we have some basis for concluding that additional variation in language structure diminishes consistency in the sequencing of cognitive development.

While these findings derive from "difficulty orderings" which are maximally faithful to the patterns extant in the data, it is appropriate to ask just how invariant these orders were. The coefficients of reproducibility for the three scales ranged from

+0.85 to +0.89, and they indicate that the orderings admit to considerable exception. A conventional minimum value for acceptable scale reproducibility is +0.90 (Torgerson, 1958).

A consideration of the nature of the tasks used in this study provides a basis for interpreting this result. The analytic method we have used -- Guttman scale analysis -- assumes that each task taps the same underlying trait, and that performance varies only with the level of the trait which is required to succeed on a given task. This assumption of a single dimension of difficulty is unsupportable, as our results demonstrate. Each of the various Piagetian problems differs not only in the sophistication of the logical operations required for solution, but it also varies in cultural familiarity, openness to perceptual distortion, relative demands upon memory, etc. Thus, the representation of problem difficulty requires at least two dimensions: one summarizing the complexity of the logical operations required for solution, and a second summarizing the extraneous situational complexities of the problem.

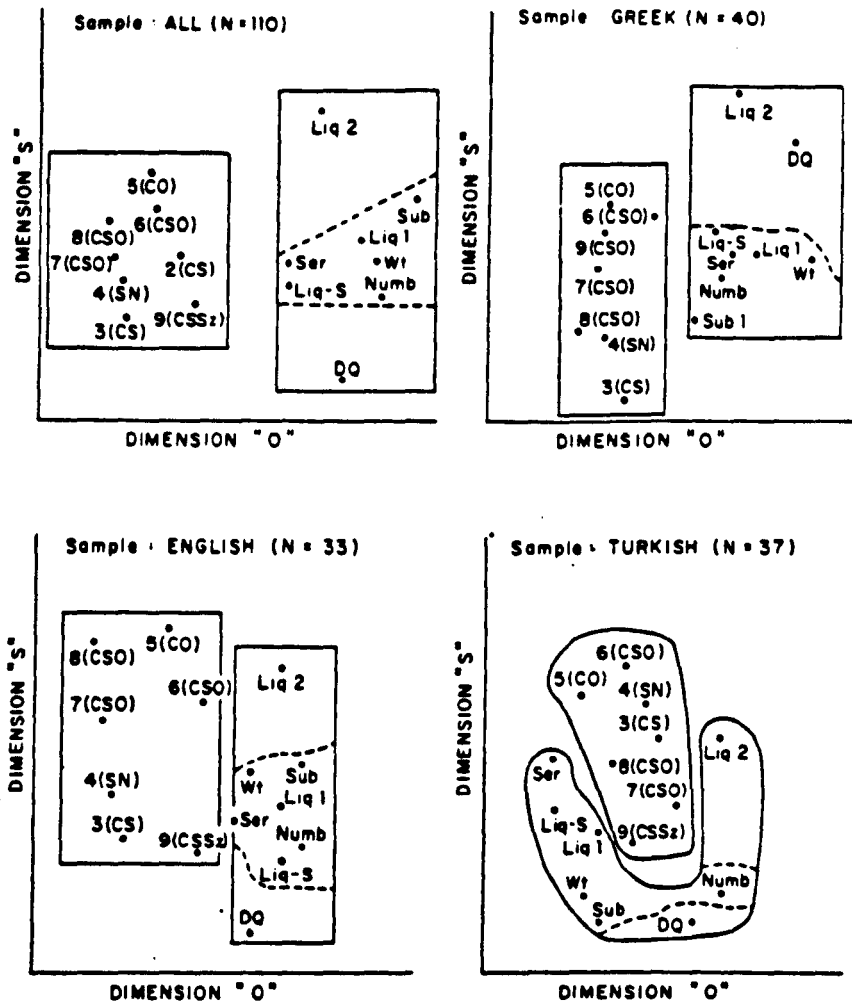
Multi-dimensionality in task difficulty is not a problem unique to the present inquiry. Such considerations inevitably arise when one attempts to conclude from a comparison of failure rates for two tasks, that one involves more complex cognitive processes. It always may be the case that a difference in the failure rates arises not from the complexity of the cognitive processes required, but rather from extraneous characteristics of the context of the problem.

5.2.2.b Multidimensional Approach. Since unidimensional analyses confound the operational difficulty of the Piagetian

tasks with extraneous contextual factors, we have employed non-metric multidimensional scaling techniques (see Kruskal, 1964) to provide a more appropriate model of the developmental structure of the concrete operational stage. Using this technique we can position the 16 Piagetian tasks in (N-dimensional) space in such a way that the distances between the tasks correspond (monotonically) to their dissimilarities. Estimates of task-dissimilarity, in turn, can be derived from the empirically observed associations (Yule's Q) between performance on each pair of tasks; for dichotomous data such as these, Yule's Q is identical to the "monotonicity coefficient" recommended by Bentler (1971).

Applying these procedures, we computed solutions for up to four dimensions, and it was found that the concrete operations problems were best represented by two axes corresponding to the operational and situational complexity of the tasks. In particular, we found a substantial reduction in stress (i.e., badness-of-fit) when we moved from a one- to a two-dimensional solution: +0.36 to +0.13, while the addition of further dimensions did not substantially reduce the stress value (+0.10 and +0.07 in 3- and 4-dimensions). These results using the total sample were replicated when the tasks were re-scaled separately for each language group. For all groups, the two-dimensional solutions were statistically reliable ($p < .05$, using the standards of Klahr, 1969).

Figure 5.2 displays the structure of the solutions obtained for the total sample, and for each group taken separately. Examining the results for the complete sample (top left panel) we



Two dimensional solutions from non-metric multidimensional scaling analysis. Points 2 through 9 represent the multiple classification tasks; classification criteria are given in parentheses (C = colour, S = shape, Sz = size, N = number, O = orientation). The other points represent the conservation and seriation problems (Liq = liquid, DQ = discontinuous quantity, Wt = weight, Sub = substance, Numb = number, Ser = seriation).

FIGURE 5.2: Multidimensional Scaling of Performance on Piagetian Tasks

find the tasks to be spatially arranged in an intuitively reasonable pattern; along the operational complexity dimension (O) the tasks form two separate clusters, one consisting of the multiple classification problems and the other of the conservation and seriation problems. (To aid interpretation, each cluster has been delimited in the figure). Furthermore, we see that the seriation and liquid summation problems are themselves somewhat isolated from the clusters of classification and conservation problems. Along the situational complexity dimension (S), the most extreme point represents the second liquid conservation problem in which the children were required to stop pouring water in time to produce equal quantities in two jars of different diameter. Since almost 50 percent of the children failed this task because they did not stop pouring in time (although they subsequently realized their error) the scale position of this task is interpretively meaningful. Similarly, the low "situational" complexity of the conservation of discontinuous quantity problem (DQ) reflects the greater availability of perceptual cues in this context; thus this representation accounts for the fact that young children who conserve quantity when the problem involves discrete units (e.g., beads), often fail to conserve when the same problem is repeated with a continuous substance (e.g., water).

Given the statistical and theoretical meaningfulness of this two dimensional representation of the concrete operational stage, we are in a position to assess the consistency of this structure across language groups. The three remaining panels of Figure 5.2 provide the needed information. Here we note that the solutions

obtained for the English and Greek samples are similar to each other and replicate the overall pattern, although there is some variation particularly in the situational complexity dimension. Nonetheless, both structures show a characteristic and theoretically appropriate division of operational complexity into two non-intersecting sets -- the classification and the conservation tasks. The structure obtained for the Turkish case, however, is quite different, and shows no evidence of an operational differentiation between the classification and conservation tasks.

The conclusions which our eyes would draw from a study of Figure 5.2 are faithful to fact. As corroboration, Table 5.2 presents correlation coefficients showing the consistency of task orderings on the two dimensions. It will be seen from these coefficients that while there is substantial consistency across language groups in the order of the tasks' situational complexity, and although there is a consistent ordering ($\rho = +0.6$) of operational complexity for the Greek Cypriot and English samples, the structure of operational complexity in the Turkish Cypriot sample appears unique.

These results are consistent with our analysis of the representation of attribute and difference relations in the three languages, but it remains to be seen whether there is an appropriate variation across languages in the relation between mastery of the comparative forms and the development of competency with classification and conservation tasks.

5.2.3 Use of Language and the Mastery of Conservation and Classification problems

Two language pre-tests provide suitable information upon the children's use of language. In the first pre-test the children

TABLE 5.2: Rank-Order Correlations Between Dimensions of the Concrete Operations Stage for Three Groups of Children

	Operational Complexity				Situational Complexity		
	T	G	E		T	G	E
Turkish	---			Turkish	---		
Greek	.08	---		Greek	.49*	---	
English	.09	.62**	---	English	.63**	.43*	---

NOTE: Values are Spearman's rank-order correlation coefficient, rho.

* $p < .05$.

** $p < .01$.

were provoked to respond in difference terms by asking that they indicate which of two pencils was longer, thicker, etc., while in the second pre-test (spontaneous usage) the children were asked simply to describe the differences between two blocks of wood. In both cases, children's responses were coded for their use of scalar, vector, bipartite and quadripartite forms. Given the focus of our interests, we will concentrate our analysis upon the use of vectors (e.g., "more") in their speech.

Overall it was found that, regardless of the language spoken, older children were more likely to use the vector forms [covariate $F(1,106) = 10.7$ (provoked), and 16.4 (spontaneous), $p < .005$]. The frequency with which vector forms were employed also varied significantly across languages and this variation replicated the pattern of group differences in performance on the conservation tasks. While 91 percent of the English children spontaneously used vectors, only 67 percent of the Greeks and 51 percent of the Turkish children used such forms [controlling age, $F(2,106) = 8.68$, $p < .001$]. Furthermore, Turkish and Greek children showed an overwhelming preference for encoding the vector sign as a separate word (*io* or *daha*) rather than using the Greek forms in which the vector sign is a suffix (-*tepo*),¹ or using the comparison by scalars (e.g., *bu ondan cok*) available in

1 For commonly used adjectives, Greek comparatives may be formed by either preceding the adjective by *ti* *io* or appending the suffix "-*tepo*". The two forms are equally correct. The present finding suggests an explanation for Kelley et al.'s (1973) observation that many bilingual children in their study could conserve in English but not in their native Greek. Their testing procedures phrased the conservation questions in the less common "-*tepo*" suffix form.

Turkish. Use of the latter forms did not exceed 10 percent in either language.

The gross relationship between use of the vector forms in Greek and Turkish and performance on the conservation and classification tasks are shown in Table 5.3. From these tabulations we see that the use of the vector forms in Greek was reliably related to performance on the conservation tasks, but there was no reliable association in Turkish. For the multiple classification tasks the reverse holds true; use of the vector form was reliably related to classification performance in the Turkish sample.

Although Table 5.3 replicates the analysis of Sinclair de Zwart, it does not take into consideration the most important developmental variable -- age. For this reason, it may be argued that Table 5.3 overstates the relationship between language and cognitive development. Since a tabular analysis of these data, controlling for age, would produce many empty cells, we have employed a regression approach to further study this relationship. Multiple regression permits us to estimate the contribution of language mastery to performance while controlling for the spurious association arising from the effect of maturation on both language acquisition and operational development.

Table 5.4 presents the result of a regression analysis in which the dependent variable was the number of classification (or conservation) problems which were correctly solved. To simplify presentation we have combined the English and Greek samples since the nature of the comparative and the multidimensional structure

TABLE 5.3: Relationship Between Use of Vector Forms of Language Pretests and Performance on the Conservation and Multiple Classification Tasks

5.3a. Conservation

Test:	GREEK				TURKISH			
	Provoked Use		Spontaneous Use		Provoked Use		Spontaneous Use	
	S	V	S	V	S	V	S	V
Pre-Op	5	3	5	3	8	1	6	3
Int	8	11	7	12	13	7	10	10
Op	1	12	1	12	5	3	2	6
	chi=6.49, p<.05		chi= 6.45, p<.05		chi= 1.99, ns		chi=2.97, ns	

5.3b. Multiple Classification

Test:	GREEK				TURKISH			
	Provoked Use		Spontaneous Use		Provoked Use		Spontaneous Use	
	S	V	S	V	S	V	S	V
Pre-Op	5	2	4	3	6	0	6	0
Int	2	8	3	7	6	1	6	1
Op	7	16	6	17	14	10	6	18
	chi=5.31,p<.05		chi=1.95, ns		chi=4.97,p<.05		chi=15.6,p<.001	

NOTE: Children were classified as vector users (V) if they used this form one or more times during the pre-test. Operational performance for both sets of tasks was defined as: Pre-operational, 0 or 1 problem solved; Intermediate, 2 to 4 problems solved; Operational, 5 or more problems correctly solved.

As a rule, chi-square results for tables with small cell sizes should be treated cautiously. In the present case, collapsing categories of operational performance and applying the Fisher exact test produces a similar pattern of results although the overall significance levels decline slightly.

of development for these groups were similar.

The coefficients shown in Table 5.4 exhibit a consistent and reliable developmental trend. For all language groups, the older children solved more conservation and classification problems than younger children; the average rate of this development was approximately two additional solutions for each three years of age. Examining the coefficients for the independent "effect" arising from the use of the vector forms we find an identical trend to that shown previously. The mastery of the vector forms has a reliable independent "effect" upon performance on the conservation tasks for the Greek and English children but not for the Turks, while for the classification tasks the reverse again holds true. By comparison to the coefficients for age, we find that these two language "effects" were weaker than the effect of maturation.

5.3 DISCUSSION OF PILOT STUDY RESULTS

The results of the pilot study (see Appendix A for copy of published report) suggested a number of important conclusions about the nature of cognitive development and the role of language during the concrete operational stage. From the pilot data it appeared that,

- 1) The concrete operational stage is not functionally unified, but rather it consists of two relatively independent sets of cognitive competencies whose order of development can vary across languages and cultures.

- 2) The latent structure of cognitive development during the concrete operational stage is multi-dimensional. Performance on

TABLE 5.4: Regression Analysis of "Effects" Attributable to Age and Mastery of Linguistic Structure of the Comparative Upon the Development of Conservation and Multiple Classification Skills

	REGRESSION COEFFICIENTS		
	Effect of age	"Effect" of language	Variance explained
CONSERVATION			
Turkish Sample	+.61	(+.04)	.39a
Greek & English Samples	+.61	+.18	.47b
MULTIPLE CLASSIFICATION			
Turkish Sample	+.52	+.40	.63c
Greek & English Samples	+.39	(+.08)	.18d

NOTE: "Effect coefficients" are standardized partial regression coefficients; analysis of the unstandardized coefficients produces similar results. Coefficients in parentheses are not reliably greater than zero (i.e., $p < .05$, one-tail). Language mastery is a dichotomous variable coded "1" if the child used a vector form in either pretest (coded zero otherwise).

- (a) $F(2,34)=11.1$, $p < .0005$.
- (b) $F(2,70)=24.6$, $p < .0005$.
- (c) $F(2,34)=28.1$, $p < .0005$.
- (d) $F(2,70)= 6.1$, $p < .005$.

any task reflects both the operational sophistication of the child and the child's developing abilities to deal successfully with the other situational demands of the task (e.g., requirements of memory, perception, etc.).

3) The structure of development during the concrete operational stage is not constant across languages. Rather, constancy in the ordering of operational development seems to arise from a common order embedded in the linguistic structure of the child's native languages. Languages (e.g., English and Greek) that code attribute and difference relationships in separate linguistic forms (scalars and vectors) show a similar division of operational development into classification and conservation skills. In such languages, mastery of the vector form is predictive of performance on the conservation problems. However, in a language (e.g., Turkish) which allows an identical form to be used in both classification and comparison, we find an overlapping in the development of conservation and classification skills, and no association between mastery of the vector form and performance on the conservation problems.

To these conclusions one must add the following qualifications. First, since the critical comparisons in the pilot study involved bilingual children, it is possible that the phenomenon discovered in the pilot study is a direct or indirect consequence of the children's knowledge of two languages. Secondly, it must be remembered that all of the pilot study evidence related to development during the concrete operational stage, and thus we do not suggest that there is variability in the ordering of Piaget's developmental stages, but rather a

variation in the structure d'ensemble with the concrete operational stage. Furthermore, even within the Greek and English samples it was not found that mastery of vector structures in language is either necessary or sufficient for the attainment of conservation. Although most theorists would agree in the conclusion that language plays a contributory role in cognitive development, there is disagreement about its relative importance vis a vis maturation (contrast, for example, Bruner, 1964 to Piaget). It was attempted by regression analysis to assess the relative contributions of language competence and maturation, and it was found that while both factors have a statistically significant "effect", the influence of maturation was found to be by far the stronger. This, of course, is consistent with Sinclair de Zwart's (1967, ch. 2) finding that formal training in language produces a slight improvement in conservation performance.

Following the publication of the pilot study results (Sevinc and Turner, 1976), Beilin (1978) reviewed this and other relevant work on language and child development in the Annual Review of Child Behavior and Development. Beilin (in common with this author) was struck by the fact that the "reversal" in the order of attaining competence on the multiple classification and conservation tasks was due to an apparent acceleration of the development of classification skills by the Turkish and Greek Cypriot children. While Beilin's puzzlement led him to wonder how the linguistic structure of the languages (Greek and Turkish) might cause such a result, results from the main study (see Chapter 7) and from secondary analysis of Heron and Dowell's

(1974) data indicated that it was the fact of bilingualism rather than the specific languages involved that was the likely explanation for this result. Thus by the time the main study data were collected there had been an important shift in the focus of the research. Rather than merely attempting a cross-cultural replication of the Piagetian research on the concrete operational stage, there was now an implicit expectation that the role of bilingualism (and biculturation) would evidence some positive benefits to the migrant children. The main research project was, by design, well suited for producing relevant evidence, since the comparisons among Turkish groups involved children at four different levels of bilingualism/biculturation - where the groups were defined by factors which were largely those of chance (e.g., who got assigned to which schools, whose parents immigration papers were processed fastest, etc.)

5.3.1 Evidence from Other Sources

As Dasen and Heron (1981:295) have noted, "Piaget's theory contends that cognitive development occurs through a series of stages that are thought to be universal, cultural factors affecting only the age at which stages are attained." The challenge of Piaget's universalist position have generated a number of cross-cultural investigations intended to provide tests of its adequacy. Summarizing their review of these cross-cultural "tests," Dasen and Heron have noted the methodological problems that afflict many of the supposed "tests" but they conclude that while "the cross-cultural data do not support every aspect of Piaget's theory, nor do they disprove it; rather, they

call for an expansion of the theory that will attribute a greater importance to cultural factors." For a theory alleging universalism in the structure of development (i.e., a structure that does not vary with culture), such a conclusion would seem akin to rejecting the basic premise of the theory, since the structure of cognitive development would be seen to be culturally determined -- at least in some respects under certain conditions. Clearly the future amendments to the theory would have to abandon the claim to true universalism of the structure of development.

The cross-cultural literature, per se, is quite extensive and it is not fruitful nor practical to attempt a comprehensive review here. Such reviews may be found both in Dasen and Heron (1981), and also in Bruner, Oliver and Greenfield (1966), Greenfield (1976), Dasen (1972, 1977, 1978), Furby (1980), and Modgil (1976) among others. We shall restrict the domain of our review to empirical research focusing on the differences between monolingual and monocultural children and bilingual and bicultural children at the concrete operational stage.

We should note, at the outset, that there is evidence that the structure of development during the concrete operational stage may not be unified in the strict sense. Heron and Dowell (1974), for example, observes that

There seems to be a good case for not regarding the concrete operations stage as a formal unity: it may be more productive to view it as a set of structures without necessary interdependence.

5.3.2 Linguistic Relativity

These results raise the broad question of "linguistic relativity" in cognitive development. We have seen that there is

a parallel between the structure of language and that of cognitive development. Where languages encode classification and difference relations into strictly separate grammatical forms there is a parallel cleavage in operational development; mastery of the comparative (vector) forms in such languages is associated with operational competence in dealing with difference and equality relations (e.g., the conservation problems). However, where languages permit classification and difference relations to be encoded in the same (scalar) grammatical form, there is no division in (concrete) operational development, and mastery of the comparative forms indicates only a higher level of classification ability.

These phenomena prompt us to recall the linguistic theories of Benjamin Whorf. In a treatise on the interrelationship of epistemology and language he wrote:

The phenomena of language are background phenomena of which talkers are (generally) unaware ... These involuntary automatic patterns of language are not the same for all men but are specific to each language ...

From this fact proceeds what I have called the "linguistic relativity principle", which means, in informal terms, that users of markedly different grammars are pointed by their grammars toward different types of observations and different evaluations of extremely similar acts, and hence are not equivalent as observers but must arrive at somewhat different views of the world. (1965, p. 221)

Stated as it is, Whorf's relativity principle is both challenging and difficult to test. However, if we view it in the framework of genetic epistemology, we can see the rich variety of contrastive developmental studies which such a principle suggests. From this perspective, we might reword Whorf's concluding sentence to read: users of markedly different grammars are pointed by their grammars toward different types of

observation with different cognitive consequences, and hence their intellectual development does not follow identical paths, but they deviate somewhat from each other in working through the basic patterns induced by maturation.

The present research is a tentative step toward the study of linguistic relativity within the context of developmental psychology. As with all such research, many further questions are raised. Initially, one would like to see these findings replicated with even larger samples of children. Some work in this direction will be presented in the following chapters but other crucial questions also remain to be considered. For example, the study of other Turkic languages (e.g., The Central Asiatic and Aralo-Caspian languages; see Menges, 1968) which encode comparisons in a manner similar to English could provide important evidence in verifying that the structure of the comparative is the critical linguistic factor in producing the patterns we have obtained.

The potential field of study, however, is not limited to the narrow focus with which we have begun, but rather it is as rich and wide as the variety of human grammars.

Chapter 6

RESEARCH DESIGN AND TESTING PROCEDURES FOR MAIN STUDY

This chapter describes the motivation and design of the main study and presents details about the samples and the tests that were used. As an aid to the reader, we begin by briefly summarizing the intent and execution of the study. Subsequently, we treat in greater depth a range of design issues affecting this work and describe the samples drawn for study. Finally, we discuss measurement issues raised by the use of Piagetian testing procedures and we document the testing protocol that was used.

6.1 OVERVIEW

At the outset of this work, our main aim was to investigate the effects that acculturation had upon the cognitive development of the children of Turkish "Gastarbeiters" in West Germany. These children had come with (or after) their parents to the industrial centers of Western Europe, particularly West Germany. By 1972 it was estimated that the Turkish migrants numbered 612 thousand workers plus dependents. The "guest workers" were concentrated in North Central Europe, with the largest number being in Germany:

Germany (West)	512,300
Austria	25,700
Netherlands	21,000
France	21,900
Belgium and Luxembourg	15,000

with smaller numbers in other European nations (Paine, 1974, p.57, Table 5). Precise data upon the size of the population of children which accompanied (or followed) this massive worker

migration is not available although it has been estimated that in West Germany alone there were a minimum of 70,000 Turkish children in 1972 (Paine, 1974, p.109). And, indeed, West Berlin now ranks as the city with the fifth largest Turkish population in the world (Rist, 1979, p.95).

The presence of such a large population of migrant children of all ages (and lengths of residence in Western Europe) offered a unique opportunity for comparative analysis. In particular, as opposed to most cross-cultural research which compares stationary populations in two cultures, there was an opportunity to study the process of acculturation into a second culture, and, of course, to examine comparison groups of non-migrants in the original and host cultures. (A listing of our specific subhypotheses^Y appears in Section 6.3.2)

As described in Chapter 5, a pilot project had been conducted in London using Greek and Turkish Cypriot migrants, plus a comparison group of (monolingual) English working class children. During the course of the pilot study an attempt was made to study the effects of linguistic forms of scalar and vector use peculiar to the Turkish language (as suggested by Piaget, 1966). It was found that the results didn't follow the results obtained from previous Piagetian studies conducted in Western cultures with Indo-European languages.

The results obtained at the concrete operational stage with the bilingual sample of Cypriot children prompted questions about the role of bilingualism, and these questions became a focus for the main research project being carried out in Germany. As a result our research goals changed and they became two-fold: (1)

to test for the effects of biculturation and movement from a rural to an urban industrial locale upon cognitive development, and (2) to examine the effect of bilingualism upon cognitive development.

The main initial hypotheses of the research were:

General Hypothesis 1: Based on the results of previous cross-cultural Piagetian studies, it was expected that there would be an increase in the rate of concrete operational performance among our migrant samples. Exposure to industrialized culture was expected to accelerate cognitive performance as found by other researchers (see Dasen, 1977), and the longer the stay (exposure) and the more intense the exposure (integration into host culture), the greater the similarity that should be expected between the Turkish migrants and the German group.

General Hypothesis 2: Also, based on the findings of the pilot study with the bilingual Cypriot population (Sevinc and Turner, 1976), it was hypothesized that there would be a reversal of the pattern of competence on the classification (matrix) tasks between monolingual non-migrant Turks and bilingual Turkish migrants to Germany.

In testing for the effects of biculturation and bilingualism upon the migrant Turkish children in Germany, a series of comparisons were made possible by the variety of educational alternatives offered to the highly concentrated migrant population in (West) Berlin. This allowed us to test for the effect, if any, of biculturation on cognitive performance in terms of both the duration of the child's stay in Germany and the type of school the children attended (integrated or segregated). Integrated schooling was thought important in facilitating competence in the language of the host country and in enabling understanding and identification with the new culture. This should result in faster acculturation. Availability of a group of German working class children further allowed us to compare the cognitive

performance of the integrated group with a comparable group of children from the host culture.

In carrying out our research we selected one non-migrant and three migrant groups for study. They were:

- (1) non-migrant Anatolian children,
- (2) segregated recent migrants,
- (3) segregated long-term migrants, and
- (4) integrated migrants.

We also selected a fifth group of working class German children and two further groups of monolingual, non-migrant Turkish children for special contrastive analyses. The additional Turkish samples differed from the main sample of non-migrant village children either in their modernity and degree of contact with urban life (coastal village sample) or in their literacy (unschooled sample of women). These additional groups will not be discussed at great length since they are rather tangential to our research interests, but we will occasionally present results for them when the comparisons are particularly informative.

6.2 INFERRING CAUSE AND EFFECT

To conduct an "ideal" experimental study of the cognitive effects of biculturation and bilingualism upon cognitive development one might wish (in theory) to do the following:

not address.

1. Specify the population of children to be studied (i.e., provide a precise definition for "Turkish children");
2. Select at random from among this population (e.g., by tossing a coin) which of these children would migrate to a second (industrialized Western) culture and insure that those not so assigned did not migrate;

3. Wait an appropriate period of time for acculturation and second language learning to take place;

4. Then measure the cognitive development of those children who migrated and those who did not.

Given such an idealized research design one could confidently attribute any observed differences in the measurements of cognitive development obtained from the two groups to the fact of migration and, perhaps, by inference to the resultant biculturation and bilingualism.

This research procedure, however, is only a flight of fancy. We do not have the option of randomly forcing families to migrate to Europe (or forbidding them to migrate) -- any groups we study will have already decided this for themselves. Some will have chosen to migrate and other will not. Thus, the effects (if any) of migration will be confounded with the effects of any other factors that covary with the decision to migrate. (One could speculate endlessly about such factors; some of the more plausible ones include socioeconomic status, traditionalism, age of parents, parents' IQ, and other "push" and "pull" factors that influence migration patterns; see Paine, 1974.) While the potential for confounding of effects is clearly present (because some of these factors may affect children's cognitive development as discussed below) it is a problem that will be faced by any study that does not meet our research "ideal" of random assignment. Moreover, it is important to realize that the present study will -- regardless of such considerations --

- allow an extensive test of the validity of Piaget's theory of concrete operational development in a non-European cultural milieu that has not previously been the subject of such study;
- provide further insight into the interaction between linguistic structure, bilingualism, and operational development in a context that involves a language whose grammar provides a unique treatment of the relevant vector and scalar forms (see Chapter 4);
- provide a description of the differences which exist between our migrant and non-migrant populations;
- permit sociological investigations of the living situation and socialization of Turkish migrants to Germany.

Moreover, procedures do exist which will allow us to begin to disentangle the effects of migration per se upon cognitive development while controlling for the confounded effects of other variables which are suspected to covary with the fact of migration. As in all quasi-experimental studies, the inference can never be as sure as the "ideal" experimental research design we fantasized earlier, but this is the inevitable price one pays for choosing to study the behavior of human beings rather than laboratory animals: random assignment to experimental treatments involving different life histories (e.g., migration or non-migration) is usually not an option.

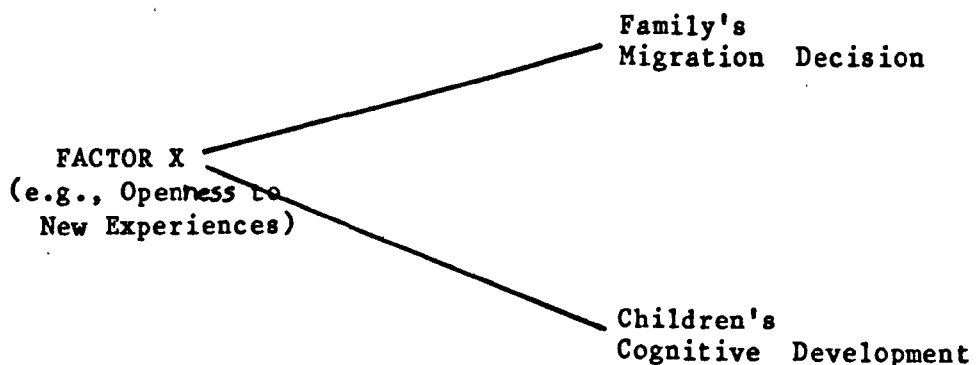
6.2.1 Design considerations and strategies of inference

There are a large number of variables which influence the decisions of Turkish laborers to migrate (or not). Some of these

factors may also have an indirect effect upon the cognitive development of the family's children, others are unlikely to affect children's cognitive development. Among the factors that might affect the decision to migrate but not affect the children's cognitive development are variables like: the past history of unemployment or earthquakes in the province in which the family resides. (Earthquakes may seem an odd choice to some readers but in Turkey they have been a savage reality and a recognized consideration in personal and governmental decisionmaking about who would migrate; see Paine, 1974, p.67). Obviously such factors are unlikely to be correlated with children's cognitive development. Other variables are more likely to influence both the family's decision to migrate and the cognitive development of the child, e.g., the social class of the family and its traditionalism or openness to new experiences. In quasi-experimental designs such as ours, the latter factors worry us because they can trick us into believing that our results demonstrate that,

Family's Migration Decision -----> Children's Cognitive Development

when the true pattern of causality is,



Or in other words we may mistake a spurious correlation between

migration and cognitive development for causation. (A spurious correlation is one that lacks any causal significance.)

Random assignment in our "ideal" experimental design would have protected us against such spurious correlations, because migration would have been random, i.e., uncorrelated with any other factor. While inferences about causality are more difficult when random assignment is impossible, quasi-experimental studies and all similar designs are common strategies of research where the "ideal" is unattainable. To confront this problem our research was designed to contrast a wide range of children at different levels of bilingualism and exposure to an advanced industrial society. The groups include:

- (1) non-migrant children resident in isolated mountain villages in Anatolian Turkey;
- (2) children in a transitional village in the same geographic area whose exposure to the outside world (and its modernizing influences) might indicate the effects of some of the factors which accompany migration but which do not involve biculturation or bilingualism;
- (3) Turkish children who had migrated to Germany only recently (0-2 years resident in Berlin) and who attended segregated schools which were taught in Turkish and attended by 80 percent of Turkish children;
- (4) Turkish children who attended the same segregated Turkish schools in Germany but who had been resident in Berlin for four or more years;
- (5) Turkish children who had resided in Berlin for four or more years and who attended integrated schools in which classes were taught in the German language; and
- (6) German working class children who attended the same integrated schools as the last mentioned Turkish group.

By choosing these groups one obtains a gradation of groups in terms of their biculturation and bilingualism. The non-migrant groups (groups 1, 2 and 6) have no exposure to a second language or culture, while the three migrant Turkish groups have

progressively greater degrees of exposure to the language and culture of their host culture. This exposure ranges from slight in the case of the recent migrants attending segregated schools, through moderate (segregated 4+ years), and the exposure reaches a maximum in the case of the integrated migrants who have lived in Germany for four or more years and who speak German and attend classes conducted exclusively in German.

The two remaining groups provide important contrasts which will allow us to assess the effects of confounding factors in our design. Thus, data for children in the transitional village in Turkey provide evidence of the effects of cultural and other variables associated with residence in a somewhat more modernized and privileged milieu in Turkey (but without bilingualism and biculturation). The uniqueness of the coastal village populations is well recognized. Thus Nyrop (1979) notes:

Villages in European Turkey and along the Black and Aegean seas and to a lesser degree along the Mediterranean Sea have long been in contact with urban and Western influences. Entire villages participate in specialized farming, fishing, and lumber production, and this specialization results in a dependency on other producers and market towns. These villages have almost always lacked the self-sufficient subsistence patterns of the Anatolian villages.

Kinship organization is important in the village social structure, but it lacks both the specificity and the intensity of kinship relations in most Anatolian villages. Economic rather than traditional kinship considerations tend to pattern social relations. The commercial nature of these villages has resulted in the substitutions of non-kinship roles--such as employer and employee, buyer and seller, and landlord and tenant--in situations that traditionally either did not exist or were handled by defined kinship relations. Most coastal villagers have a broader social awareness than Anatolian villagers and are more susceptible to national influences. (p.113-114).

Finally, data for German working class children provide evidence of the effects of exposure to an industrialized Western culture

and mastery of the German language without bilingualism or biculturation.

Given this graded array of exposure to a second language and culture (i.e., groups 1+2 and 6 vs. 3 vs. 4 vs. 5) the focus of our analysis will be on the progression of differences across the groups rather than upon the simple comparison of a migrant versus a non-migrant group. In addition, the non-migrant groups provide the possibility for estimation of some of the cognitive effects of variables other than bilingualism/biculturation which are incidental to migration (e.g., exposure to new experiences, better material standard of living, etc.). Furthermore, since social and cultural information is being collected in addition to measures of cognitive development, it will be possible to use regression and partial correlation techniques to control for the effects of many potential confounding factors.

6.3 SAMPLES TESTED

6.3.1 Samples

All in all, this research, exclusive of the pilot study, involved the testing of 486 subjects over a two year period. Details for each of the separate samples is provided below. In the concluding section of this chapter, the testing procedures used with these samples is described in detail.

Non-Migrants Turks. 162 Anatolian children resident in four villages in the mountainous area of Anatolian Turkey (see map) which borders upon the Black Sea were tested. The villages themselves are isolated, particularly in winter, and all the

villagers are occupied in farming, save for the two authority figures in each village: the muhtar (village leader) and imam (priest). The villages lacked electricity, running water, and motorized transport. The primary means of transportation were by donkey, by horse, or by foot. It was a two to five hour walk along goat paths from these villages to the Black Sea coast. Each village, however, had access to a primary school, and all children were required to attend the primary school until the age of 14.

The author lived in each of the four mountain villages from January through June of 1975 and tested every child registered and attending the primary schools.

Migrant Turks. 202 Anatolian children who were born in the villages of Anatolian Turkey and who had migrated with their parents to West Berlin were tested. The parents of these children are "guest workers " (Gastarbeiters) who constitute an underclass in Germany; they work, by and large, at jobs that German workers refuse to perform (e.g., dustmen, so-called "unskilled" labourers in factories, dishwashers, janitors, etc.). While the families of these children are deprived by German standards, the standard of living of these guestworkers is, in most respects, in general much more "privileged" and "modernised" than that found in the villages from which the workers came. The relative economic rewards derived even from the lowly occupations performed by these workers in Germany are many times greater than the economic opportunities available in their native villages, which, of course, accounts for the influx of migrant workers from Turkey and other third world nations into Germany. Between

September, 1975 and July, 1976, the author resided in an immigrant area of West Berlin (Schoeneberg), and, with the assistance of the staff of the Wissenschaftszentrum (Science Center) in Berlin, obtained permission to carry out field work in the Berlin schools.

As previously noted, this group of migrant children is divided into several subsamples which are of importance for our analysis. These subdivisions reflect the varying types of educational services offered to the migrants and the length of children's residency in Germany. The subgroups include:

Integrated Migrants: One group of children, whom we will call "integrated migrants," were sampled from among the Turkish children attending regular German schools in Berlin. These children were all resident in Berlin three or more years. They were instructed in a German curriculum; only minor allowances were made for their migrant status (e.g., four hours per week of instruction in Turkish language and culture organised by the Turkish Consulate).

Segregated Migrants: A second group of migrant children were selected from among the children attending special Turkish schools in Berlin. These schools are administered by the German Education Authority and staffed by Turkish teachers. These schools offer a curriculum in Turkish which includes only 4 hours of instruction per week in German. For analytic purposes, this group may be subdivided into two further groups: long-term migrants (4+ years resident in Germany), and recent migrants (6 to 24 months resident in Germany.)

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Map of Turkey: location of villages included in Non-Migrant segment of study is shaded

Non-Migrant Germans:¹ A small sample (n = 65) of working class German children was also obtained for contrastive analyses. These children were selected from the same schools attended by the sample of Integrated Migrants so as to increase the comparability of the groups' educational experiences.

Additional Groups: During the course of the Anatolian portion of the study, two additional samples were tested. These included a sample of non-literate village women and a sample of children from a semi-modernised Anatolian coastal village.

The illiterate women (n = 29) were tested in a village where females have traditionally not been sent to school as a result, this village has a female population which is illiterate.

Children (n = 28) were also tested in a coastal village which we will call a "transitional" village. We differentiate this "transitional" village from the others for the following reasons. First, the village had easy daily access to a nearby town (Inebolu was 30 minutes away by organised motor transport). Secondly, almost all of the children had lived in Istanbul for some period of time, e.g. while visiting relatives, and the population of this village

¹ Testing for this phase of the study was conducted with the assistance of a native German speaker. The tester was a student in his final year of study at the Free University of Berlin; he was completing a research thesis on the administration of the Piagetian conservation problems.

was also exposed to outsiders and tourists during the summer. Third, the village had a market on a weekly basis during the summer. Women from the surrounding villages came to the "transitional village" to sell their farm products in order to buy manufactured goods. Finally, the village had some basic stores and amenities. For example, it had a grocer, fish-monger, tailor, shoe repairer, hardware store, a telephone connection to the city, a post office, and electricity in the public cafe. It also had an emergency health clinic staffed by a midwife and nurse. (The clinic was intended to serve the surrounding villages as well.)

6.3.2 Specific Hypotheses

As noted previously our initial general hypothesis was that exposure to industrialized culture would accelerate cognitive development: the longer and more intense the exposure the greater the acceleration of development. This general hypothesis leads to several more specific sub-hypotheses:

Sub-hypothesis 1: All of the Turkish migrant samples should show more advanced levels of cognitive development than the non-migrant Anatolian samples (since they have greater exposure to industrialized Western culture).

Sub-hypothesis 2: Among the non-migrant Anatolian Turkish samples, the transitional village sample should show more advanced levels of cognitive development than the mountain village samples (due to greater exposure to a more complex social order).

Sub-hypothesis 3: Among the various groups of Turkish migrants to Germany, the levels of their cognitive development at each age should reflect the degree of their exposure to and integration into German society. Thus the highest level of development would be expected from the integrated long-term migrants, a lesser degree from the long-term segregated migrants, and the lowest level from the short-term segregated migrants.

Sub-hypothesis 4: If it is only exposure to advanced industrial society that accelerates development (and not biculturation or bilingualism), we would not expect any group of migrant Turkish children to exceed the performance of native German children (of the same age). If, on the other hand, there were advantages to experiencing two cultures or learning two languages, it is possible that some of the migrant groups might surpass the native Germans in their cognitive development.

The results of the pilot study led us consider language and bilingualism as important factors in determining the cognitive development of children. We hypothesized (prompted in part by the comments of Beilin) that bilingualism/biculturation might cause a reversal of the ordinary sequence of development at the concrete operations stage -- with bilingualism causing the classification skills to develop before conservation. From this general hypothesis follows an important subhypothesis:

Sub-hypothesis 5: Among the various groups, the largest differences in performance should appear for multiple classification performance (since this is the domain most affected by bilingualism).

There are several other subhypotheses which are treated in our analysis of results, we list some of these briefly below; they will be discussed more fully in Chapters 7 and 8:

- that there should be an association between language development (e.g., mastery of vector terms) and cognitive development;
- that the association between language development and cognitive development will be largely due to age (maturity increasing the sophistication of the child's language and the level of his cognitive development);
- when age is controlled, there will be a more modest level of association between linguistic performance and cognitive performance.

- the difficulty of the Piagetian tasks should cluster and at least two dimensions will be required to represent their difficulty, e.g., operational difficulty and situational difficulty of the tasks;

6.4 PIAGETIAN TASKS AND TESTING PROCEDURES

In this final section we consider two topics of relevance to our assessment of the cognitive development of these samples within the Piagetian framework: the procedures used for scoring (Judgement only versus judgement plus explanation); and the reliability of the Piagetian tasks and testing procedures. The final part of this section presents the protocols used in administering the tasks and in scoring results.

6.4.1 Judgement Versus Explanation As Performance Criteria

At the practical level the use of "judgement only" criteria in the scoring of performance on Piaget's tasks is appealing. Firstly, the length of testing periods is substantially diminished when only judgements are elicited. Secondly, the judgement itself is a more "objective" datum and thus it is less subject to experimenter distortion [see Rosenthal's (1966) work on the effects of experimenter bias] than the interpretations of verbal explanations. Lastly, the use of judgement alone avoids the problems raised by the significant lack of consistency among previous researchers in their methods of classifying explanations. As Brainerd (1973) observed in his review of the subject:

Unfortunately, little or no consensus exists among such [Piagetian] researchers on the matter of what constitutes an adequate explanation. While there is extensive agreement that an adequate explanation must be preceded by a correct judgement, there is little agreement beyond this point (p.177).

In comparing the assessment techniques employed by Bruner and his collaborators (1964) and Braine (1959), with the "methode clinique" of Piaget and his associates, Gruen (1966) observes that:

the different methods they have employed have led them to study qualitatively different phenomena. The discrepancy in age norms suggest that they are not studying the same cognitive process (p.978)

Gruen proceeds to demonstrate an interaction between the type of assessment criteria employed and verbal pretraining in the use of the words (more-equal-less) for number conservation. He finds that five-year olds taught to interpret the number conservation questions (e.g., are there more corks in this row?) to refer to numerosity (i.e., more in number, not longer, etc.) showed significantly improved performance when Bruner's judgement criteria were employed, but not when the Piaget-Smeldsund "explanation" criteria was used.

Gruen argues that the different modes of assessing conservation flow from different theoretical definitions of the process. Since Piaget holds that the logical operations of reversibility, compensation, and logical necessity underlie conservation, he requires the eliciting and scoring of the child's explanations for their conservation judgements. A correct judgement is not ^{an} evidence for operational development unless, according to Piaget, it is accompanied by an operational explanation. Bruner's approach, however, does not focus as directly on the underlying mental operations, and so the

judgement criteria is seen as an adequate measure of the child's cognitive maturity.

In a reconsideration of this matter Brainerd (1973) has rejected Gruen's argument as to the appropriateness of "explanation" to Piaget's theories of cognitive structure. Specifically, he draws attention to the postulated non-verbal nature of the structures which Piaget hypothesizes, and the treatment of "language" as a dependent variable in the theory (i.e., cognitive structures determine language development not vice versa). Nonetheless, while rejecting explanation as a necessary condition for conservation, he admits that,

Explanations can supplement judgments in such a way that one is provided with insights into the nature of the structure or structures under consideration (p.174)

These insights, of course, are of great relevance and importance to an adequate theory of cognitive functioning.

Since explanation data collected in the manner of Piaget and Smeldsund also contain an indication of the child's judgement, the two techniques are not mutually exclusive at the level of research practice. In addition to providing consistency with the main body of research in the area (that of Piaget and his collaborators), use of both judgement and explanation questions in the testing provide data for additional analyses of the implications of the two different scoring criteria in the analysis of cognitive development (i.e., one can score the results in both manners and assess the empirical implications of the alternative methods).

Thus, the strategy adopted in the present research is to

gather data both on children's judgements and their explanations of these judgements, so that comparative (age) norms for the two scoring procedures can be obtained in our data analysis.

Assessing the reliability of the scoring methods employed in the research is of critical importance. This importance results not only from the desire to determine the effects of random measurement errors in the testing, but also from the need to rule out observer bias (see Rosenthal, 1966) as a confounding variable in the research. Despite the general importance of such reliability testing for all Piagetian research, it, apparently, is seldom employed. Piaget, for example, does not report such investigations in his own works.

Reliability data from a few studies is available. In a methodological investigation of Piaget's work, Almy (1970) reports that altering the wording of questions, and the sex of experimenters had little effect upon the performance of American schoolchildren. Chittenden (1964) reports a range of agreement between two coders of 91.6 percent to 100 percent in their judgements of operational level [N = 60 children; tests: conservation (2), seriation (2), and equivalence (2)]. Almy (1970) reports no statistically significant shifts in performance on conservation tasks when children were re-tested by a second experimenter (two-weeks after initial testing). She also reports a 0.76 correlation as the test-retest reliability of the multiple classification (matrix) tasks. Laurendeau and Pinard (1963, 1970) present similar findings for their researches.

6.4.2 Contacting Samples

The samples for this research came from two sources. For the first part of the study, the monolingual samples were stationary and native children of small villages near the city of Kastamonu in the Northwestern part of Turkey (see map). Children were selected on an age basis (6-13 year olds) from among the children who attended primary schools. (Primary schooling is compulsory in Turkey.) Their dates of birth were gathered from school records. In total, 190 Anatolian children were tested; they consisted of 95 boys and 67 girls from mountain villages, and an additional 12 boys and 18 girls from a (transitional) coastal village. Permission for testing in Turkey was obtained from local authorities and village leaders (Muhtar).

For the second part of the study which was conducted in West-Berlin, samples were obtained from among the children of Turkish migrant workers (Gastarbeiters). All these children were attending primary schools at the time of testing. They were selected on the basis of their age and of their background, that is being of rural origin, with fathers having been employed as cultivators of land, and the children themselves having lived in farming villages prior to their coming to Berlin.

Official permission for testing in Germany had been obtained beforehand from the district educational authorities through the intercession of the Wissenschaftszentrum in Berlin. Schools were visited in several districts where the Turkish population was concentrated (Kreutzberg, Schoeneberg, and Wedding). Initial contact was made with the principal. Subsequently, we were taken to visit the classrooms. We asked the Turkish children in each

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CONCENTRATION OF MIGRANT POPULATIONS IN WEST -BERLIN

class to raise their hands if they had been living in Berlin for four or more years or in other cases less than 2 years. Then these children were asked where they were born in Turkey. After this information was obtained, their school records were requested from the administration. Their birth dates were recorded. We tried to keep the number of boys and girls equal in each class, and we selected children born in the underdeveloped regions of Turkey. After fulfilling these requirements of the sampling design, the resultant lists of names of children who would be tested, were given to the teachers.

During the testing itself, any children who didn't meet our criterion of being monolingual Turks (e.g., Kurds, Suryanis and other minority ethnic groups from Anatolia) were excluded from the sample. In total, 268 children were tested in Germany; they consisted of:

124 Segregated Turkish Children (70 boys; 54 girls)

81 Integrated Turkish Children (50 boys; 31 girls)

63 German Children (34 boys; 29 girls)

Our sample of German children came from the same district and schools as the sample of integrated Turkish children in West Berlin. They were mainly of working class background; their parents were generally employed as blue collar workers.

6.4.3 Test administration

Testing was conducted wherever appropriate space could be found in the schools, e.g., teacher's rooms, empty classrooms, projection rooms, auditoriums or reading rooms. All testing was conducted during regular school hours between 8 o'clock and 2

o'clock. The children took time off from classes to participate in the testing in two sessions. First a short questionnaire was given to obtain background information on their families and basic attitudes toward the country of origin and the host country (see Appendix). They were also asked to give a description of life back in Turkey and a reflection upon their childhood experience. Children attending fourth grade or higher were also given Rosenzweig's Picture-Frustration Test.

To determine their social image and consciousness, and future aspirations, the children from fourth grade on were asked to place their mother's and father's occupation on a scale of 1 to 5. They were also given a list of 25 occupations to put on the same scale to assess their perception of occupational status and prestige. Often their objective evaluation of an occupation and subjective assessment of their parents' occupation were inconsistent suggesting the children's need for higher status and approval.

Children were subsequently told that we would play a couple of games and that during the course of these games, they would be asked some questions which they should answer in any way they felt like. The interviewer made the point that there were no right or wrong answers and that the answers given wouldn't affect their school evaluations in any way.

The testing material was laid out on a desk next to the testing table where children could see and explore the equipment. The testing took place with the tester sitting opposite the child. The experimenter was perceived as a visiting teacher. (The effect of sex of the tester shouldn't have been a

confounding factor, since both in the villages in Turkey and in Berlin, the children had familiarity with both male and female teachers.)

For the first couple of testings, a tape-recorder was used to record all the answers and the comments made by the child; these recordings were used to double check against a hand-written record sheet. After a number of testings, we were quite assured that we could take down the child's full responses on prepared record sheets. The exact words of the child's responses and comments on his performance were written out by the tester. The children were later classified as conservers or nonconservers according to the criteria of accurate judgement with adequate explanation. These data were eventually transcribed unto coding sheets and prepared for keypunching on computer cards.

The testing with Turkish children was conducted mainly by the author with the help of three other Turkish testers who were trained to give the Piagetian tasks under the supervision of the author. The German children were tested by a native Berliner who was working on his Ph.D. thesis in cognitive psychology. (The German translations of the tests and the tasks were done by Elke Kroger and back translated into English by Hans Herzog, another German psychology student.)

The children were first given the base-line tests to determine their understanding of the key words used in the Piagetian tasks: scalars, and vectors, and qualitative relational terms such as some, more, less. These tests were adapted from Sinclair de Zwart (1967) by John Versey (1974). Each testing session lasted approximately half an hour. The tasks were

distributed so that the conservation of solid quantity task was at the beginning and the conservation of weight at the end of the testing. (We were hoping to counteract any learning effect on these two similar tasks by keeping them as far apart as possible.)

6.4.4 Schedule of Testing

The first part of the testing was conducted in Turkey in early 1975:

Transitional Village: January - March, 1975

Mountain Villages: April - June, 1975

The second part of the testing was conducted in West Germany from late 1975 through mid-1976:

Preparatory Classes (Segregated): December, 1975 - March, 1976

Integrated Schools: April, 1976 - June, 1976

6.5 PROTOCOL FOR ADMINISTRATION OF PIAGETIAN TESTS

6.5.1 Scoring of Conservation tasks

For each conservation tasks, judgements were elicited and recorded. Subsequently, the child's explanations for his judgements were requested. These explanations were taken as evidence of operational thought if they employed one (or more) of the following concepts:

- a. simple reversibility; e.g., "if you pour it back into the

the other container it will be the same level"

- b. compensated reversibility; e.g., "this one is higher, but the other one is wider"
- c. positive identity, e.g., "it is the same substance"
- d. negative identity, e.g., "nothing has been added or taken away"; "it is simply a matter of pouring."

6.5.2 Scoring of Multiple classification tasks

Children's responses to three questions (adapted from Inhelder and Piaget, Early Growth of Logic, 1964) were used to categorize their responses to the multiple classification tasks:

- 1. Firstly, the child's selection of the appropriate figure;
- 2. Secondly, records were made of each applicable classification criterion the child employs. For the first 4 matrices, there is a maximum score of two; for the remaining items there is a maximum score of three.
- 3. Finally, the stability of the child's choice was assessed by his behavior in response to the question, "Will any other figure fit (into the matrix) equally well or better?"

6.5.3 Testing Protocol

The following script shows for each conservation and classification task, the apparatus that was used in the testing, any operations performed by the tester, and the questions asked of the child.

BASE-LINE TESTS

Provoked use of qualitative words (relational terms): (same, more, less)

Apparatus: A: 5 red counters
 B: 4 green counters
 C: 5 blue pencils
 D: 3 red pencils of equal length
 E: 10 sticks of different length
 F: 6 marbles

Instruction: Here are some groups of things. We have a group here (A), another here (B), a group here (C), a group here (D), another group here (E), and a group here (F).

Instruction: Now look at this group (A). I want you to show me another group which has the same number as this group (A).

Instruction: Show me a group which has more than this group (A).

Instruction: Show me a group which has less than this group (A).

PROVOKED USE OF SCALARS AND VECTORS

(Adapted from Sinclair-de-Zwart, 1967)

Apparatus: 5 pencils
 A: long and thin
 B: short and thin
 C: long and thick
 D: short and thick
 E: standard hexagonal pencil 15 cm. long

Instruction: Here you see these pencils. Can you tell me something about them?

Instruction: Show me a pencil which is long and thick.

Instruction: Show me a pencil which is longer than that one.

Instruction: Show me a pencil which is shorter and thinner than this one (C).

SPONTANEOUS USE OF VECTORS AND SCALARS: DIFFERENCES

(Adapted from Sinclair-de-Zwart, 1967)

Apparatus: (Two pieces of wood both painted the same color)
 a. $25 \times .9 \times .9$ cm. weight 15 gm.
 b. $10 \times 4.6 \times 4.6$ cm. weight 160 gm.

Instruction: Here are two pieces of wood

Question: Can you tell me the difference between them?

Question: Can you tell me any other differences between them?

Instruction: Pick them up, one in one hand, one in the other.

Question: Can you tell me any difference between them

SPONTANEOUS USE OF QUALITATIVE WORDS: RELATIONAL TERMS

(Adapted from Sinclair-de-Zwart, 1967)

Apparatus: 4 big marbles - 2 small marbles
 2 small plastic dolls, each presented with same size plastic plate.

Instruction: Here you see some marbles. I am going to distribute them between these two sisters.

Operation: 4 big marbles are put on one plate and 2 small marbles on the other plate.

Question: Is it fair?

Question: Why (or why not)?
 Question: Can you make it fair?
 Question: Is it fair now?
 Question: Why?

PIAGETIAN TASKS

SERIATION

Apparatus: 10 wooden sticks all painted the same color. The shortest being 9 x 0.9 x 0.9 cm; increment 1 cm. The sticks are presented in random order and laid flat on the table.

Instruction: Show me the smallest stick

Instruction: Now find one that is a tiny bit bigger than that one

Instruction: Show me the biggest

Instruction: Show me the one that is a tiny bit smaller than that one

Instruction: I want you to put these in order starting from the smallest going up to the biggest so that when you finish they form a staircase like this (indicated on the table the way it should look). Try to put first the smallest, then a little bit bigger, then another a little bit bigger, and so on.

Instruction: Now you can start.

Question: Are you finished?

In the event that the child arranges the sticks in a manner that is almost correct (i.e. one or two sticks out of place) the interviewer probes his understanding of the task by asking

Question: Can you make it look better?

CONSERVATION OF CONTINUOUS QUANTITY: LIQUID

Subtest A: Equalities

Apparatus: Two small cylindrical glass containers A1 and A2: 5 cm. high with 4 cm. internal diameter. A1 approximately half-filled with colored liquid. Another cylinder 10 cm. high - 6 cm. wide containing colored liquid X.

Instruction: I am going to pour some of this liquid (X) into this jar (A2) and I want you to tell me to stop pouring when there is the same amount in this jar (A2) as in this one (A1). Tell me to stop pouring when there is the same amount.

Question: Is there the same amount?

Question: Why?

Subtest B: Transformation

Apparatus: Jar (A1) of subtest A plus tall and narrow measuring cylinder (B1) 13 cm. high with 1.5 cm. internal diameter.

Instruction: I am going to pour this jar (A2) into this one (B1).

Question: Is there the same amount in this jar (B1) as in this one (A1)?

Question: Why (or why not)?

Question: Does one have more?

Subtest C: Equalization using distractor

Apparatus: A1, A2 plus a cylindrical glass jar of the same internal diameter as (A) but 10 cm. high (B2)

Instruction: I am going to pour some liquid from this jar (X) into this jar (B2). Tell me to stop pouring when there is the same amount as in here (A1).

Question: Is there the same amount?

Question: Why?

Subtest D: Generalization

Apparatus : A1, A2 and a standard glass beaker 7 cm. high, 5.5 cm. internal diameter (B3).

Instruction: I am going to pour some liquid from this jar (X) into this jar (B3). Now I want you to tell me to stop pouring when there is the same amount in this jar (B3) as in this one (A1). Tell me to stop pouring when there is the same amount.

Question: Is there the same amount?

Question: Why?

Question: Is there the same amount to drink?

Subtest E: Division

Apparatus: A1, A2, plus 4 smaller jars (C1-4) each 3.5 cm. high with 2 cm. internal diameter.

Instruction: (equalization as in subtest A) I want you to tell me to stop pouring when there is the same amount in this jar (A2) as in this one (A1).

Question: Is there the same amount?

Instruction: Here you see these jars. I am going to pour this jar (A2) into this jar (C1), into this jar (C2), into this jar (C3), and this one here (C4).

Question: Is there the same amount in all of these jars (C1-4) as in this one (A1)?

Question: Why?

Question: If I pour all of these jars back together in this jar (A2) will there be the same amount as in this jar (A1)?

CONSERVATION OF CONTINUOUS QUANTITY: SOLID

Apparatus: Four balls of plasticine in the ratio of volume 4-2-2-1 (unit weight 25 gm.)
4 (multicolored)
2 (plain)
2 (multicolored)
1 (plain)

Instruction: Show me the balls which have the same amount of plasticine in them.

Question: If I roll this one into a sausage, will the sausage have the same amount as this ball? (indicating the other)

Operation: One of the two equal balls is rolled out into a sausage 10 cm. long.

Question: Does this sausage have the same amount of plasticine as the ball?

Question: Why (or why not?)
 Question: Does one have more?

CONSERVATION OF DISCONTINUOUS QUANTITY

Subtest A: Transfer to another container

Apparatus: 23 multicolored beads in a container, 2 equal sized small glass beakers (A1, A2), one long and thin measuring cylinder (B1) used in the liquid subtest B.

Instruction: Here we have some beads and these jars. When I put a bead in my jar (A1), you put a bead in your jar (A2). Ready?

Operation: 10 beads each are dropped in two separate jars leaving 3 in the container.

Instruction: Right, we'll stop here.

Question: Are there the same number of beads in this jar (A1) as in your jar (A2)?

Question: Why or why not?

Operation: Equalize if child requests.

Instruction: Watch now, I am going to pour these beads (A1) into this jar (B1)

Question: Are there the same number of beads in this jar (A) as in this one (B1)?

Question: Why or why not?

Question: Does one have more?

CONSERVATION OF NUMBER

Subtest A: tower and cross

Apparatus: Two heaps of counters
 13 red counters
 15 green counters

Instruction: We are going to make towers with these counters. I want you to put down a counter every time I put down a counter. I put a counter down, you put a counter down.

Operation: When one to one piling of counters is finished, the subject is left with two spare ones on the table.

Instruction: Now, I have used all mine, you leave those on the table.

Question: Is there the same number of counters in your tower as in my tower?

Question: Does one tower have more?

Instruction: I am going to put mine down like this (pattern resembling a cross)

Question: Are there the same number of counters in my cross as in your tower?

Question: Why (or why not)?

Question: Does one have more?

Subtest B: One-to-One Correspondence (Based on Rothenberg and Courtney, 1969)

Apparatus: Heap of red counters
 Heap of green counters

Operation: 9 red counters are spaced out equally 2 cm. apart from each other in a straight line. 9 green

counters are put to one to one correspondence with the top row.

Question: Is there the same amount in each row?

Question: Why?

Operation: If the subject agrees that the two rows have the same amount, then one counter is removed from the same end of each row (red, green) and placed aside in full view on the table.

Expansion: Experimenter's red counters (R) are spaced out more so that the row appears longer than the row of green counters (G).

Question: Are there the same number of counters in each row?

Question: Why or why not?

Question: Does one row have more?

Contraction: The experimenter's row (R) - the more spaced out one is now collapsed so the neighboring counters are touching each other.

Question: Does this row (R) have the same number of counters as this row (G)?

Question: Does one row have more counters?

Question: Which one?

CONSERVATION OF WEIGHT: SOLID

Apparatus: 4 similar balls of plasticine used for the task of conservation of substance in the ratio of volume 4-2-2-1 unit weight 25 gm.

Instruction: Show me the two balls which weigh the same? You can pick them up and see which ones weigh the same.

Question: If I roll this one into a sausage, will it weigh the same as this ball?

Operation: One of the two equal balls is rolled out into 9 sausages 10 cm. long.

Question: Does this sausage weigh the same as this ball?

Question: Why (or why not)?

Question: Does one weigh more?

CONSERVATION OF DISTANCE: (SPATIAL AND TEMPORAL RELATIONS)

Apparatus: 2 wires of 20 cm. and 15 cm. length

Question: Here we have these wires. Are they the same length?

Instruction: Now we are going to bend one of these wires (A1) like this.

Operation: One of the wires is bent into a zigzag shape. They are laid down one end of each corresponding to the other.

Instruction: Suppose there are two ants moving along these wires to get to their home at the end of each wire.

Question: When each ant reaches its home base, will they have walked the same distance?

Question: Does one have to walk more (longer) to get home (on the straight wire) how long will it take for this ant (on the zigzag wire) to get home?

Question: Will they get home at the same time?

MULTIPLE CLASSIFICATION MATRICES

Apparatus: Nine sets of matrices, as described in Inhelder and Piaget, 1964, pp.159-169. All the choices for the missing pattern are presented at the same time and can be placed into the blank space by the experimenter upon child's request until his choice is stable.

Matrix 1 (Practice Item)

Instruction: I am going to show you some cards with pictures on them. Here is one with circles and squares. There is one missing in this picture, (pointing to the blank space.) I want you to show me which one of these (pointing to the choice pictures) would fit in here (pointing to the blank space) to make the pattern look right this way (horizontally) and this way (vertically). Now you choose the one that fits best.

Question: Why did you choose that one?

Question: Is there another one which would fit better instead?

Question: How can you tell it goes best with the others?

If the child gives the correct response and explanation, the interviewer says:

"That is right. This row has things that are the same shape" (pointing to the horizontal row) "and this row has things that are the same size," (pointing to the vertical row).

If the child has been unable to choose the correct card, or if he has chosen the card but is unable to articulate the correct reason for doing so, the interviewer places the correct card in the matrix and says: "This is the one that goes best with the others. The pictures in this row (horizontal) are the same shape, and the pictures in this row (vertical) are the same size."

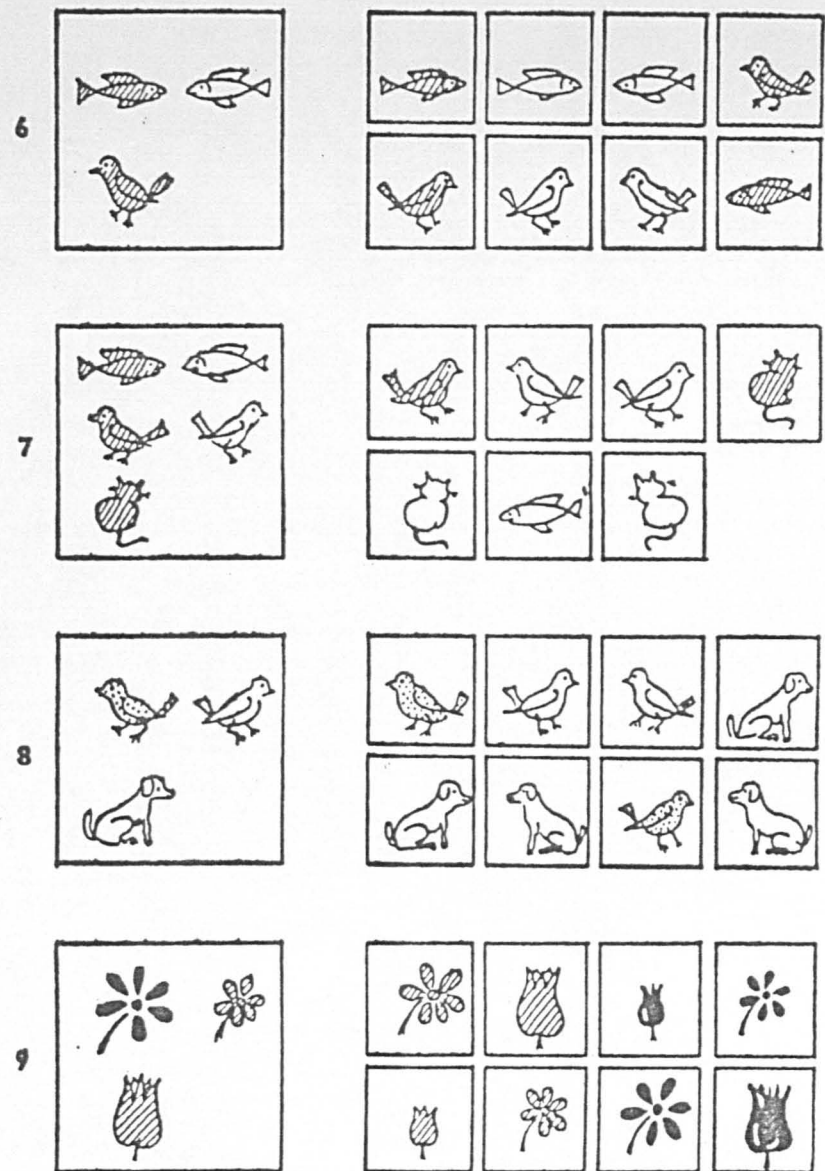
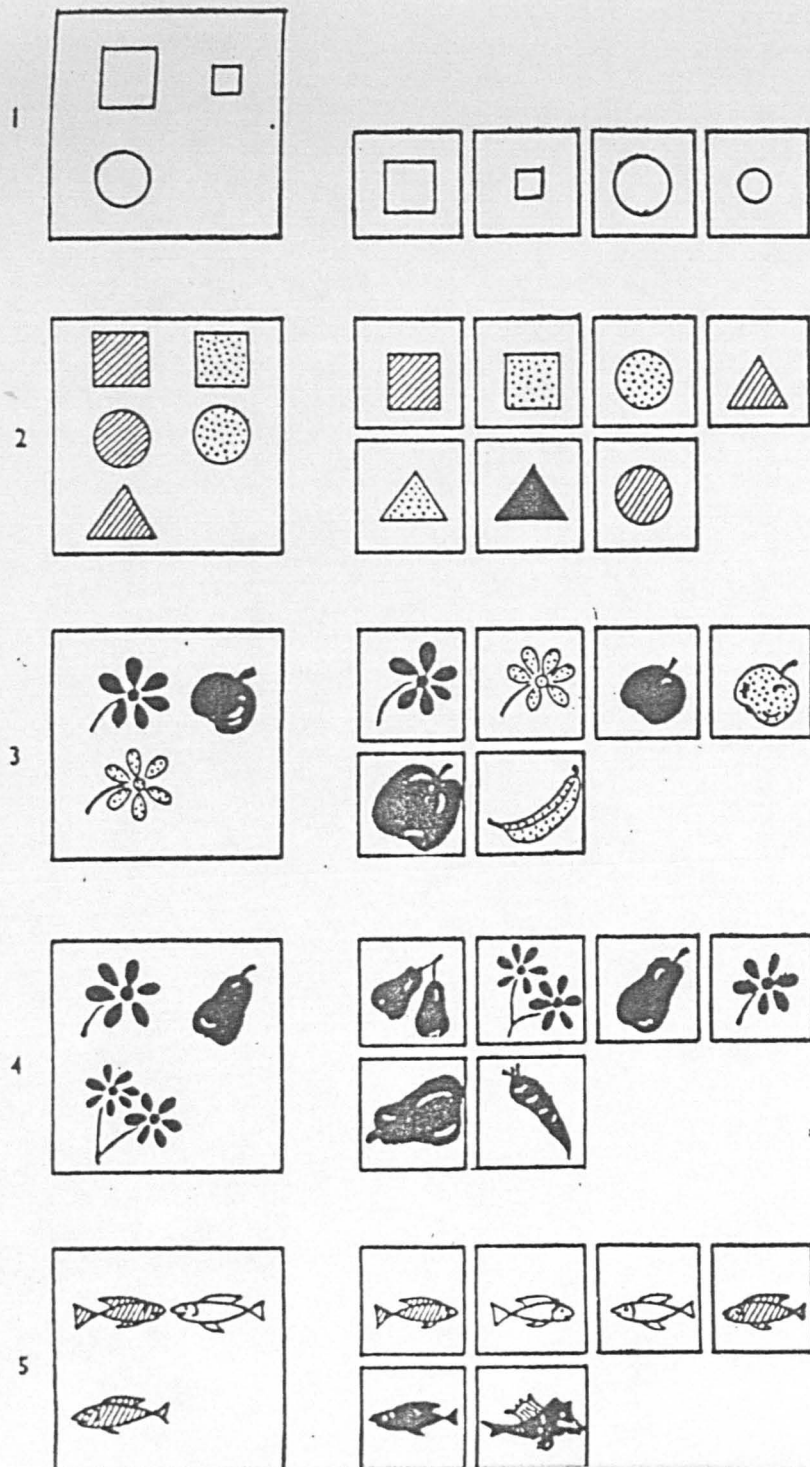
NOTE: This explanation is only made for the first practice item.

Matrices 2 to 9

Instruction: Now let's look at this card. I want you to show me which one of these (pointing to the choice pictures) would fit in here (pointing to the blank space) to make the pattern look right this way (horizontally) and this way (vertically). Now, choose the one that fits best.

Question: Why did you choose that one?

Questions: Is there another one which would fit better?



(Multiple Classification)

- 6.31.a -

Figure 10.

It should be noted that Matrix 8 is incorrectly shown both in Inhelder and Piaget (1964, p. 161) and Almy et al (1976, p.47) in that "dogs" numbered 4 and 6 in the choice set appears plain and should be spotted, otherwise there is no correct solution. (And one non-solution choice appears twice)

Versey, 1974, p. 78

Chapter 7

RESULTS I: FINDINGS OF CROSS-CULTURAL ANALYSES

The present chapter examines the cross-cultural results of the main study. That is to say, the present chapter is designed:

- (1) to assess whether the results obtained from different cultural groups (and groups in various phases of inter-cultural transition) are different, and
- (2) to specify the manner in which those differences arise (e.g., are they simple differences in level or degree of development or does the structure of development itself vary between cultural groups).

7.1 STRATEGY OF ANALYSIS

A major interest in this research was to discover the effect of migration as an acculturation influence on children whose life experiences were formerly limited to rural and agricultural village life. To test for this effect, our basic comparison uses groups of children who were presumably alike in all other characteristics.

The groups tested in this study might be seen as ordered along a scale in terms of their biculturation and bilingualism. At one end of the scale we had children still living in their traditional environment in Anatolia, at the other end we had

Anatolian children who had migrated to West Berlin. This latter group of migrant children was further broken down into three different groups in accordance to their length of residence abroad and the types of schools they were attending:

1. Segregated preparatory classes and less than two years residence in Germany;
2. Segregated preparatory classes and four or more years of residence in Germany;
3. Integrated schooling (all of whom had 4+ years of residence in Germany)

The data from these migrant groups can be compared to assess the effects of varying degrees of biculturation and bilingualism. Moreover, at the extremes we also have samples of non-migrant children of similar ages and social backgrounds from the origin and destination culture. All these non-migrant children are, of course, monolingual and monocultural. Our design thus enables us not only to look at the effects of different degrees of exposure to a second language and culture, but also to anchor this analysis in the baselines provided by the children who have not had any (intensive) experience of a second language or culture and who live in the origin and destination cultures of our migrant samples.

Our samples also allow us to conduct a test of whether it is the length and intensity of children's exposure to a Western industrialized culture or the acquisition of a second language and second culture that is the major factor in altering the rate of children's cognitive development. A crude test is possible because our samples will produce two different orderings based on

(1) contact with "advanced industrial" society versus (2) degree of biculturation and bilingualism. In particular, assuming West Berlin to be more of an "advanced industrial society" than rural Turkey, we obtain the following ordering:

1. German children (nonmigrant) [MOST WESTERNIZED]
2. Integrated Turkish Migrants to Germany
3. Segregated Turkish Migrants to Germany (long-term residents)
4. Segregated Turkish Migrants to Germany (short-term residents)
5. Turkish Transitional village children
6. Turkish mountain village children (nonmigrant) [LEAST WESTERNIZED]

However, in terms of their biculturation and bilingualism we have a rather different ordering:

1. Integrated Turkish Migrants to Germany [MOST BILINGUAL and BICULTURAL]
2. Segregated Turkish Migrants to Germany (long-term residents)
3. Segregated Turkish Migrants to Germany (short-term residents)
4. Turkish village children (Mountain & Transitional) [LEAST BILINGUAL and BICULTURAL]
(TIED)
4. German children (nonmigrant)

Thus, our samples permit some tests of the relative contribution of "exposure to advanced urban industrial society" and bilingualism upon children's cognitive development. If the only important influence on cognitive development were bilingualism, then we would expect the groups' performances to follow the second ordering, other things being equal. If, however,

Westernization were the overriding influence, we would expect the performances of the various groups to follow the first ordering.

7.1.1 Hypothesis Testing Procedures

The basic hypothesis to be tested in this analysis is whether or not children growing up in different cultural millieux develop cognitive skills at a different rate. We will begin our attempt to answer this question by comparing the proportions of children passing each task, while controlling for the age of the children. At the outset a few words of introduction to our mode of analysis are appropriate.

7.1.1a Analysis of Covariance and analogous multiple regression procedures are used to test if performance on each task differed between samples when age is controlled. In our first formal analysis of the data from the main study we will report the results of 18 analyses (1 for each task) of the children's performance. The covariate in these analyses will be age. The outcome or dependent variable will be whether the child passed the test or not, that is did the child give the right judgement with an operational explanation, or not. Those who passed the task are assigned the score of one, those who did not are given a score of zero.

What the result of the analysis of covariance can tell us is:

whether one sample of children performed differently than the other -- taking into account any effects that may be due to slight variations in the ages of the children in each sample.

Or to be even more precise,

it tests the null hypothesis that performance of each sample was equivalent, save for any effects that may arise from differences in the age composition of the samples.

In this regard it should be noted that there are only 4 (of 81) integrated migrants aged six to seven, while 26 were aged twelve to thirteen. In contrast, among the nonmigrants from the mountain villages, there were considerably more six and seven year olds (18 of 153) and fewer twelve and thirteen year olds (20 of 153). Clearly, in assessing the overall performance of these groups, we must allow for the fact that the mountain village sample contained a relatively large number of very young children (who could be expected to perform poorly on the tests), and relatively fewer of the older children (who could be expected to perform well).

7.1.1b Example. The analysis of covariance (and similar multiple regression procedures) provide us with an appropriate tool for adjusting for the effects of such differences in the age composition of the different samples. (This tool allows us to determine if one group does better, regardless of their age. To consider this point in concrete terms, consider the fictional data presented in Figure 7-1. It can be easily seen from Figure 7-1a that, ignoring age, the NonMigrant children do better than the Integrated Migrant children in this fictional example. Specifically, 53% of the NonMigrant children are classified as "operational" compared to 37% of the Integrated Migrant children. A simple analysis of variance to test the null hypothesis that these two groups perform equivalently would yield:

F ratio= 11.97, df=1/428, $p < .001$

indicating that there is only 1 chance in 1000 (i.e. $p < .001$) that the Integrated Migrant children and NonMigrant children would obtain equivalent passing rates (or the Integrated Turks would do better than the NonMigrant) if we repeated the study drawing new samples of children.

However, it is also true that the NonMigrant children in our hypothetical example are older than the Integrated Migrant children. To control for age we perform an analysis of covariance (with age as the covariate). This analysis indicates that, when age is controlled, the results are reversed. The Integrated Migrant children in this fictional example do better than their NonMigrant counterparts of the same age (see Figure 7-1b). Controlling for age, the analysis of covariance tells us that the performance of the Integrated Migrant children is significantly superior:

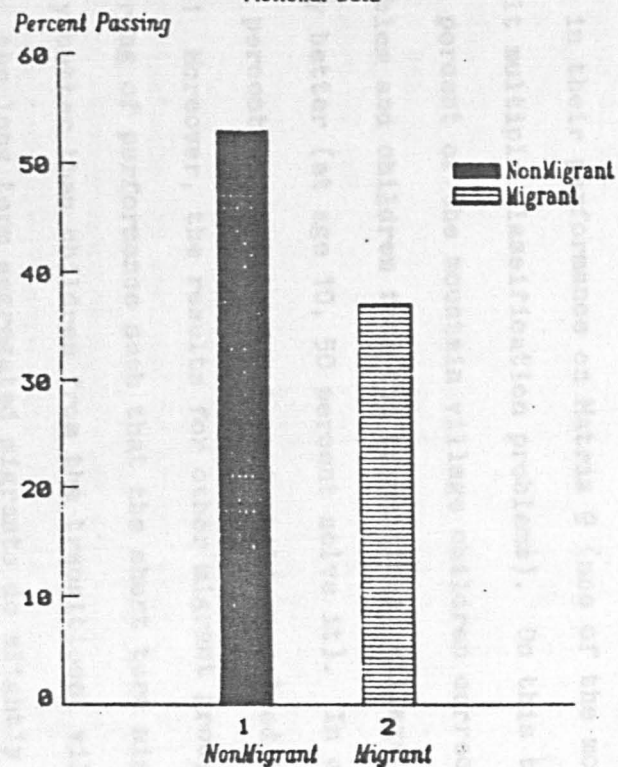
$$F\text{-ratio} = 22.55, df = 1/427, p < .001$$

This divergence between the results of (1) the analysis of variance and (2) the analysis of covariance, occurs because in the former we ignored age, and in the latter we adjusted for it. Since the age composition of the two samples varied considerably and since age has a strong effect on performance, the two analyses of these fictional data reach different conclusions.

Clearly, if one is interested in intergroup differences in performance, analysis of covariance is the more appropriate analysis strategy. It is for this reason (i.e., to protect against potential effects of slight variations in the age composition of the samples), that analysis of covariance and analogous multivariate regression procedures are employed

PERFORMANCE IGNORING AGE

" Fictional Data "



FICTIONAL DATA USED IN ANALYSIS OF COVARIANCE EXAMPLE

Group and Age	Number Failing	Number Passing
Integrated Migrants		
5 year olds	100	20
6 year olds	18	18
7 year olds	4	8
8 year olds	3	9
9 year olds	1	19
TOTAL	126	74
Non-Migrants		
5 year olds	9	1
6 year olds	9	1
7 year olds	9	1
8 year olds	40	40
9 year olds	40	80
TOTAL	107	123

PERFORMANCE CONTROLLING AGE

" Fictional Data "

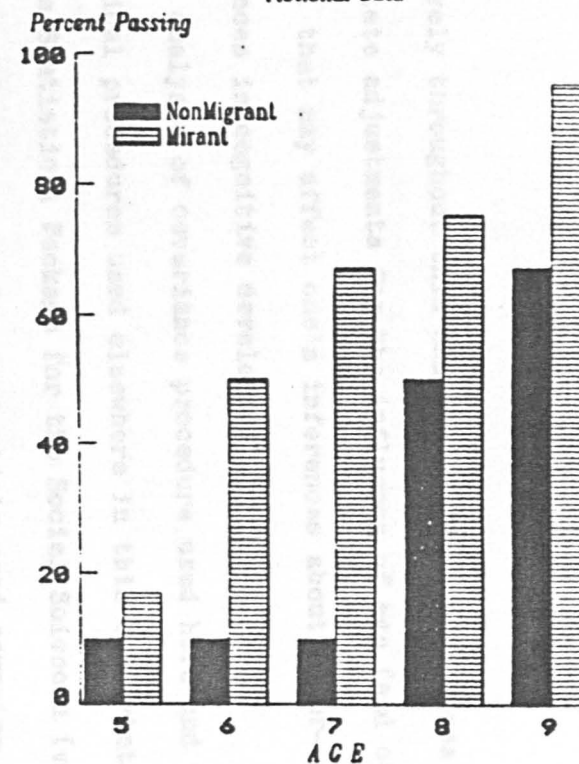


Figure 7-1 Analyses of Fictional Data to Demonstrate Need For Appropriate Controls for Age Composition of Samples

extensively throughout this chapter. . These procedures provide appropriate adjustments for the influence of age (and other factors) that may affect one's inferences about inter-sample differences in cognitive development.

The analysis of covariance procedure used here and the other statistical procedures used elsewhere in this dissertation were from the Statistical Package for the Social Sciences (versions SPSS and SPSS-X), one of the most widely used computer packages for statistical analyses.

7.2 FINDINGS ON INTERSAMPLE DIFFERENCES IN PERFORMANCE

Table 7-1 displays the percentage of children at each age who succeeded on the various Piagetian tasks used in the main study. It will be seen by looking at Table 7-1 that there is an apparent variability in the pattern of intersample differences in performance on the conservation and multiple classification tasks. Note, for example, the large differences between the samples in their performance on Matrix 9 (one of the most difficult multiple classification problems). On this task less than 30 percent of the mountain village children correctly solved the problem and children from the transitional village do only slightly better (at age 10, 50 percent solve it). In contrast, over 70 percent of integrated migrant children solved this problem! Moreover, the results for other migrant groups suggest an ordering of performance such that the short term migrants do slightly better than children from the transitional village, and, in turn, the long term segregated migrants do slightly better than the short term segregated migrant children. We also note

Table 7-1 Percent Passing Piagetian Conservation Tasks and Multiple Classification Matrices for Samples in Main Study

TASK and SAMPLE	A G E			
	6-7	8-9	10-11	12-13
Seriation				
Mountain Villages	44.4%	71.1%	82.6%	90.0%
Coastal Village	50.0	50.0	90.0	(100.0)
Segregated 0-2 Yrs.	50.0	100.0	89.3	100.0
Segregated 4+ Yrs.	62.5	77.8	100.0	100.0
Integrated	(100.0)	100.0	100.0	(92.3
Germans	88.9	90.5	100.0	(100.0)
Conservation of Discontinuous Quantity				
Mountain Villages	38.9	57.8	81.2	80.0
Coastal Village	16.7	90.0	90.0	(100.0)
Segregated 0-2 Yrs.	37.5	41.2	75.0	(100.0)
Segregated 4+ Yrs.	28.6	66.7	63.6	81.3
Integrated	(50.0)	63.6	85.2	88.0
Germans	77.8	61.9	72.4	(100.0)
Conservation of Continuous Quantity (Solid)				
Mountain Villages	5.6	66.7	76.8	80.0
Coastal Village	16.7	60.0	60.0	(50.0)
Segregated 0-2 Yrs.	37.5	52.9	82.1	(100.0)
Segregated 4+ Yrs.	50.0	50.0	77.3	81.3
Integrated	(100.0)	52.2	71.4	92.3
Germans	77.8	85.7	82.8	(75.0)
Conservation of Weight				
Mountain Villages	11.1	53.3	65.7	65.0
Coastal Village	16.7	40.0	60.0	(50.0)
Segregated 0-2 Yrs.	37.5	52.9	71.4	(100.0)
Segregated 4+ Yrs.	57.1	66.7	66.7	75.0
Integrated	(75.0)	56.5	71.4	76.9
Germans	75.0	66.7	48.3	(25.0)

(Cont'd)

NOTES. Percentages are enclosed in parentheses if they are based on fewer than five observations. These observations should be treated with extreme caution since they are subject to large sampling errors and considerable rounding error. (Results for children less than six or more than thirteen years and for the sample of uneducated females are not shown here in order to conserve space.)

Table 7-1 (Cont'd) Percent Passing Piagetian Conservation Tasks and Multiple Classification Matrices for Samples in Main Study

TASK and SAMPLE	A G E			
	6-7	8-9	10-11	12-13
Conservation of Number (Towers and Cross Problem)				
Mountain Villages	16.7%	53.3%	48.6%	60.0%
Coastal Village	33.3	60.0	50.0	(100.0)
Segregated 0-2 Yrs.	0.0	29.4	50.0	100.0)
Segregated 4+ Yrs.	12.5	44.4	59.1	43.8
Integrated	(50.0)	30.4	64.3	(84.6
Germans	44.4	66.7	69.0	(100.0)
Conservation of Number (1 to 1 Correspondence)				
Mountain Villages	44.4	64.4	64.3	75.0
Coastal Village	16.7	70.0	70.0	(100.0)
Segregated 0-2 Yrs.	62.5	70.6	89.3	100.0)
Segregated 4+ Yrs.	12.5	77.8	95.5	93.8
Integrated	(50.0)	78.3	75.0	(73.1
Germans	44.4	71.4	82.8	(100.0)
Conservation of Liquid 1				
Mountain Villages	33.3	75.6	92.9	80.0
Coastal Village	33.3	70.0	80.0	(50.0)
Segregated 0-2 Yrs.	37.5	88.2	92.9	(100.0)
Segregated 4+ Yrs.	57.1	77.8	95.5	93.3
Integrated	(75.0)	87.0	100.0	96.2
Germans	55.6	76.2	82.8	(100.0)
Conservation of Liquid 2				
Mountain Villages	50.0	77.8	77.1	70.0
Coastal Village	16.7	50.0	70.0	(50.0)
Segregated 0-2 Yrs.	50.0	64.7	85.7	(100.0)
Segregated 4+ Yrs.	28.6	66.7	81.8	93.8
Integrated	(50.0)	82.6	100.0	96.2
Germans	22.2	61.9	75.9	(75.0)
Conservation of Liquid 3				
Mountain Villages	50.0	62.2	92.9	80.0
Coastal Village	50.0	90.0	70.0	(100.0)
Segregated 0-2 Yrs.	62.5	88.2	82.1	(100.0)
Segregated 4+ Yrs.	42.9	66.7	85.5	93.8
Integrated	(100.0)	69.6	92.9	88.5
Germans	11.1	38.1	51.7	(50.0)
Matrix 2				
Mountain Villages	88.9	77.8	90.0	100.0
Coastal Village	100.0	100.0	100.0	(100.0)
Segregated 0-2 Yrs.	62.5	88.2	100.0	(100.0)
Segregated 4+ Yrs.	57.1	88.9	100.0	100.0
Integrated	(100.0)	100.0	100.0	100.0
Germans	77.8	95.2	100.0	(75.0)

(Cont'd)

Table 7-1 (Cont'd) Percent Passing Piagetian Conservation Tasks and Multiple Classification Matrices for Samples in Main Study

TASK and SAMPLE	A G E			
	6-7	8-9	10-11	12-13
Matrix 3				
Mountain Villages	50.0%	48.9%	65.7%	60.0%
Coastal Village	16.7	70.0	80.0	(0.0)
Segregated 0-2 Yrs.	50.0	76.5	64.3	(100.0)
Segregated 4+ Yrs.	62.5	66.7	86.4	93.8
Integrated	(100.0)	87.0	92.9	100.0
Germans	66.7	90.5	96.6	(100.0)
Matrix 4				
Mountain Villages	22.2	17.8	17.1	30.0
Coastal Village	0.0	50.0	30.0	(0.0)
Segregated 0-2 Yrs.	25.0	70.6	67.9	(50.0)
Segregated 4+ Yrs.	50.0	61.1	86.4	62.5
Integrated	(75.0)	95.7	89.3	88.5
Germans	77.8	66.7	89.7	(100.0)
Matrix 5				
Mountain Villages	5.6	28.9	30.0	20.0
Coastal Village	50.0	60.0	40.0	(0.0)
Segregated 0-2 Yrs.	12.5	52.9	42.9	(50.0)
Segregated 4+ Yrs.	50.0	44.4	63.6	62.5
Integrated	(25.0)	78.3	71.4	73.1
Germans	44.4	57.1	79.3	(50.0)
Matrix 6				
Mountain Villages	24.4	30.0	15.0	12.5
Coastal Village	50.0	40.0	40.0	(50.0)
Segregated 0-2 Yrs.	37.5	58.8	39.3	(50.0)
Segregated 4+ Yrs.	25.0	44.4	63.6	37.5
Integrated	(50.0)	65.2	71.4	53.8
Germans	22.2	61.9	58.6	(50.0)
Matrix 7				
Mountain Villages	11.1	24.4	32.9	40.0
Coastal Village	50.0	20.0	60.0	(50.0)
Segregated 0-2 Yrs.	25.0	17.6	40.7	(25.0)
Segregated 4+ Yrs.	12.5	33.3	59.1	25.0
Integrated	(50.0)	56.5	71.4	76.9
Germans	44.4	42.9	65.5	(75.0)

(Cont'd)

Table 7-1 (Cont'd) Percent Passing Piagetian Conservation Tasks and Multiple Classification Matrices for Samples in Main Study

TASK and SAMPLE	A G E			
	6-7	8-9	10-11	12-13
Matrix 8				
Mountain Villages	20.0%	21.4%	25.0%	25.0%
Coastal Village	16.7	30.0	50.0	(50.0)
Segregated 0-2 Yrs.	25.0	35.3	42.9	(75.0)
Segregated 4+ Yrs.	12.5	33.3	68.2	68.8
Integrated	(50.0)	82.6	85.7	69.2
Germans	11.1	57.1	62.1	(75.0)
Matrix 9				
Mountain Villages	11.1	13.3	28.6	20.0
Coastal Village	33.3	20.0	50.0	(0.0)
Segregated 0-2 Yrs.	25.0	47.1	53.6	(100.0)
Segregated 4+ Yrs.	25.0	50.0	68.2	66.7
Integrated	(100.0)	78.3	71.4	88.5
Germans	33.3	57.1	79.3	(100.0)
SAMPLE SIZES				
Mountain Villages	18	45	70	20
Coastal Village	6	10	10	2
Segregated 0-2 Yrs.	8	17	28	4
Segregated 4+ Yrs.	8	18	22	16
Integrated	4	23	28	26
Germans	9	21	29	4

that the integrated migrant children turn in a performance on this problem that parallels and, indeed, seems to surpass that of the German children.

This pattern appears to be repeated for several other multiple classification problems (see especially, matrices 4, 6 and 7). The conservation problems, however, yield a more mixed pattern of results. For example, on the conservation of discontinuous quantity task, there seems to be no clear ordering of superior performance. Among the six and seven year olds, the German children do quite well (78 percent pass) and the Transitional Village sample quite poorly (17 percent pass), but among the 10 to 11 year olds this result reverses itself (the best performance of any group is that of the transitional village and the worst that of the Germans). However, the differences between the performance of the various groups is often not large, e.g., among the 10 to 11 year olds the best group on the discontinuous quantity task solve 90 percent and the worst solved 60 percent. (The comparable comparison on Matrix 9 is 29 percent for the worst group versus 79 percent for the best performing group.)

Of course, analysis by eye of such a complex array of data is dangerous. It is very easy to deceive oneself. It is for this reason that a more formal statistical procedure is appropriate.

7.2.1 Tests for Intergroup Differences

Table 7-2 presents a covariance analysis which compares the performance of our six main groups, while controlling for the (linear) effects of age upon the likelihood that a child would

TABLE 7-2 F-ratios from Analysis of Covariance (Controlling Age) of Passing Rates on Seventeen Piagetian Tasks, and Subgroup Deviations (Controlling Age) From Average Passing Rates.

TASK	TEST OF SAMPLE DIFFERENCES (a)		DEVIATIONS (b)					
	F Ratio	p	Mount.	Coast.	Seg.	Seg.	Integ.	German
			Vill.	Vill.	0-2 Yrs	4+ Yrs		
Continuous Quantity	2.219	0.061	-0.03	-0.13	0.03	-0.04	0.01	0.14
Weight	1.532	0.179	-0.04	-0.14	0.05	0.07	0.07	-0.03
Discontinuous Quantity	0.908	0.475	-0.00	0.11	-0.05	-0.06	0.04	0.02
Number (Tower & Cross)	2.939	0.013	-0.04	0.07	-0.08	-0.09	0.06	0.17
Number (1 to 1)	2.768	0.018	-0.08	-0.08	0.12	0.09	0.00	0.04
Distance and Time	4.615	0.001	-0.12	-0.06	-0.03	0.06	0.15	0.10
Liquid 1	2.113	0.063	-0.03	-0.13	0.05	0.02	0.08	-0.04
Liquid 2	3.877	0.002	-0.01	-0.19	0.04	-0.01	0.14	-0.10
Liquid, Sum & Division	9.808	0.001	0.03	0.05	0.11	0.04	0.06	-0.32
Seriation	6.631	0.001	-0.10	-0.13	0.05	0.03	0.09	0.11
Matrix 2	2.941	0.013	-0.05	0.09	-0.00	-0.01	0.06	0.02
Matrix 3	11.479	0.001	-0.16	-0.13	-0.03	0.08	0.19	0.18
Matrix 4	45.801	0.001	-0.34	-0.23	0.09	0.16	0.36	0.28
Matrix 5	13.779	0.001	-0.22	0.02	-0.04	0.10	0.23	0.19
Matrix 6	9.899	0.001	-0.20	0.03	0.06	0.06	0.20	0.13
Matrix 7	9.000	0.001	-0.14	0.05	-0.09	-0.03	0.24	0.15
Matrix 8	19.517	0.001	-0.24	-0.03	0.01	0.08	0.32	0.12
Matrix 9	24.404	0.001	-0.27	-0.11	0.07	0.10	0.30	0.20

Note. Analysis includes children aged 6 to 14 years.

(a) All F ratios have d.f. = $\frac{5}{16/453}$. P-value of 0.001 is shown whenever $P < 0.0005$.

(b) Deviations can be interpreted as differences in proportion of children in sample who solved specified problem (versus proportion solving it in total sample). For example, a deviation of -0.10 for Group X on a given task would indicate that this group's passing rate on the task was ten percentage points below that of the total sample.

pass a given task. This analysis¹ indicates that for five of the nine conservation tasks there were significant differences (at .05 level) between the cultural groups. In two cases (the two number conservation tasks) the German samples perform best of all groups; in two cases (distance-time and the second liquid conservation task), the Integrated Migrant sample are superior; and in the remaining case the segregated migrants (0-2 years) evidence superior performance, with the Integrated Migrants being second best. On the seriation task there is a significant difference in performance with the groups ranked in order of their performance as follows: German, Integrated Migrants, the two Segregated Migrant groups, and then the non-migrants.

While the differences in group performance are significant in five cases, the differences are not massive nor overly reliable (the median F value for test of differences was only 3.3). A rather different pattern of results was obtained for the multiple classification tasks. In every case, the covariance analysis indicates a significant difference in the age-controlled passing rates for the five groups. Moreover, with only one minor exception,² the age-controlled passing rates reveal a consistent ranking of performance. The groups' performances were ordered:

¹ The analysis is restricted to the 6 to 13 year olds since data on other age groups were not collected in all cultural groups.

² The sole exception is for Matrix 2 where there is a reversal by a single percentage point in the ordering of the two segregated groups. The age-controlled passing rate for the 0-2 year Segregated Migrants was 93 percent, while the 4+ year Segregated Migrants had a 92 percent adjusted passing rate.

- | | |
|------------------------------------|---------------------|
| 1. Integrated Migrants; | [BEST PERFORMANCE] |
| 2. German Working-class | |
| 3. Segregated Migrants, 4+ years; | |
| 4. Segregated Migrants, 0-2 years; | |
| 5. Non-Migrant Mountain Villagers | [WORST PERFORMANCE] |

Interestingly, we also note that children from the transitional coastal village did consistently better than children from the mountain villages. Indeed, for a few problems, their performance surpassed that of the short-term segregated migrants to Germany. We also note that the inter-group differences in performance on the multiple classification tasks are more substantial and reliable (median $F = 15.7$) than those obtained in the analysis of data from the conservation tasks.

As an aid to understanding these results, Table 7-3 presents a simplified analysis which is restricted to the three large Turkish samples (Mountain Village Sample; Segregated; and Integrated Migrants). This analysis combines the two Segregated Migrants samples into one group of both short- and long-term segregated migrants. In addition, instead of presenting "deviations" from average performance as in Table 7-2, this analysis shows the more concrete and easily understandable age-adjusted passing rates for children in each sample at 10.4 years (the mean for all samples). Reading down the column of age-adjusted passing rates, one can easily see the consistent pattern of superiority in multiple classification performance by the more bilingual and bicultural samples. On Matrix 8, for example, the rates are 79 percent passing for the Integrated Migrant sample,

TABLE 7-3 F-ratios and Age adjusted passing rates from analysis of covariance of performance of Turkish Mountain Village and Migrant Samples on each Conservation and Multiple Classification Task

Task	Sample	Age Adjusted Passing Rates	F Ratio	p
Matrix 2	Integrated Migrants	93%	3.5	.05
	Segregated Migrants	92		
	Non-Migrants	89		
Matrix 3	Integrated Migrants	93	20.0	.001
	Segregated Migrants	79		
	Non-Migrants	58		
Matrix 4	Integrated Migrants	87	78.8	.001
	Segregated Migrants	61		
	Non-Migrants	19		
Matrix 5	Integrated Migrants	78	36.3	.001
	Segregated Migrants	52		
	Non-Migrants	24		
Matrix 6	Integrated Migrants	66	22.8	.001
	Segregated Migrants	43		
	Non-Migrants	23		
Matrix 7	Integrated Migrants	67	17.5	.001
	Segregated Migrants	38		
	Non-Migrants	29		
Matrix 8	Integrated Migrants	79	53.4	.001
	Segregated Migrants	49		
	Non-Migrants	19		
Matrix 9	Integrated Migrants	81	55.1	.001
	Segregated Migrants	67		
	Non-Migrants	21		

(Cont'd)

Note. Samples are exclusively Anatolian Turkish children, either Migrants or non-Migrants residing in Anatolia. See text for detailed description of each sample. This table excludes children aged 4 to 5 and 14 to 15 years because of small sample sizes and fact that they were included in only a few samples.

(a) Covariance analyses test the significance of differences between the three samples (segregated, integrated, and non-Migrants), after first adjusting for the effects of age upon performance. For all tests, the degree of freedom were 2/337.

(b) Age adjusted passing rates reflect the performance in each subgroup of children of an age equivalent to that of the average of the entire sample, i.e., the performance expected of children in each subsample aged 10.4 years.

TABLE 7-3(Cont'd) F-ratios and Age adjusted passing rates from analysis of covariance of performance of Turkish Mountain Village and Migrant Samples on each Conservation and Multiple Classification Task

Task	Sample	Age Adjusted Passing Rates	F Ratio	p
Conservation of Liquid 1	Integrated Migrants	91	3.1	.001
	Segregated Migrants	88		
	Non-Migrants	80		
Conservation of Liquid 2	Integrated Migrants	90	5.0	.01
	Segregated Migrants	79		
	Non-Migrants	72		
Conservation of Liquid (Sum & Division)	Integrated Migrants	89	8.2	.001
	Segregated Migrants	89		
	Non-Migrants	73		
Conservation of Substance (plasticene)	Integrated Migrants	72	0.6	ns
	Segregated Migrants	71		
	Non-Migrants	66		
Conservation of Weight	Integrated Migrants	66	2.0	ns
	Segregated Migrants	63		
	Non-Migrants	54		
Conservation of Discontinuous Quantity	Integrated Migrants	77	0.9	ns
	Segregated Migrants	67		
	Non-Migrants	71		
Conservation of Number	Integrated Migrants	68	3.6	.05
	Segregated Migrants	46		
	Non-Migrants	49		
Seriation	Integrated Migrants	97	11.5	.001
	Segregated Migrants	90		
	Non-Migrants	76		
SAMPLE SIZES	Integrated Migrants	81		
	Segregated Migrants	121		
	Non-Migrants	153		

49 percent for the Segregated Migrant samples, and 19 percent for the Non-Migrant sample. In contrast, the conservation and seriation problems show a more mixed pattern with much less dramatic differences between the passing rates of the different groups.

7.2.2 Constructing Summary Measures

To pursue this analysis in greater depth, it is desirable to construct summary measures of children's performance. There is a large, technical literature on the psychometrics of scale construction (summarized in Nunnally, 1967), to provide guidance. Our basic goal is to have summary indicators of children's overall performance on the conservation tasks and on the multiple classification tasks. These summary indicators can then serve as the dependent variable in our analyses of intergroup differences. Such summary measures have two advantages. First, they simplify the analytical task and the discussion of results, since we will have only two dependent variables to consider rather than having to consider separately performance on each of 18 individual tasks. Secondly, the use of so-called multiple indicators of children's performance can provide a more reliable measurement of the children's cognitive development. This is so because, although a child may by accident fail one task that he, in fact, knows how to do, it is less likely that he will fail a whole series of tasks by accident. Thus a summary measure taking into account performance on an array of problems can provide a more reliable indicator of overall competence.

Simple summary indicators can be constructed by adding up the

number of conservation problems that the child answered correctly, and also the number of multiple classification problems that were correctly answered. These sums can then be expressed as percents, e.g., a given child solved 75 percent (6 of 8) of the multiple classification problems and 60 percent (6 of 10) of the conservation problems. These "average" passing rate can then serve as a summary indicator of the child's performance on the classification and conservation tasks.

Before proceeding with this approach, it is necessary to consider the extent to which these individual tasks can be combined into summary scales. The psychometric approach to this question provides a formal procedure for assessing the extent to which these individual tasks could be treated as components of such a summary scale of operational functioning. A key concept in the psychometric approach is the formal assessment of the extent to which each of the tasks measures the same trait or attribute. (In a later section of this chapter we will consider some alternative ways of "scaling" these tasks using Guttman scaling and nonmetric multidimensional scaling.)

7.2.2a Psychometric Scale Analysis. As a first step in considering this issue Table 7-4a shows the correlations (Pearson product moment correlations) between performance on each of the multiple classification tasks and Table 7-4b shows correlations for each of the conservation and seriation tasks. These correlations were computed across all children in the study. It can be seen from these correlation coefficients that performance on each of the tasks is significantly correlated with performance on all other tasks. In all but ^{three} ~~two~~ instances the observed

correlation is significantly larger than zero at the .05 level and in most instances the observed correlation is significant well beyond the .01 level. The magnitude of the observed

TABLE 7-4a Pearson Product Moment Correlation Coefficients between Performance on Conservation and Seriation Tasks (Using all Samples)

	Seriata	DQ	CQ	WT	N:T-C	M-1	Liq1	Liq2	Liq3
Seriation	1.0000								
Discont. Quantity (DQ)	.1957	1.0000							
Cont. Quantity (CQ)	.2384	.3252	1.0000						
Weight (WT)	.2333	.1802	.5078	1.0000					
Number: tower/cross (N:T-C)	.1415*	.3708	.2517	.2087	1.0000				
Number: 1 to 1 (M-1)	.2945	.2228	.2632	.2018	.2478	1.0000			
Liquid 1 (Liq1)	.3435	.2987	.4180	.2854	.2422	.3655	1.0000		
Liquid 2 (Liq2)	.3032	.2212	.2484	.1852	.1280*	.3104	.4331	1.0000	
Liquid 3 (Liq3)	.2053	.2077	.1821	.1613	.1037*	.2417	.3652	.3410	1.0000

Note. All correlations, except those marked with an asterisk, were significant at .05 level.

TABLE 7-4b Pearson Product Moment Correlation Coefficients between Performance on Multiple Classification and Seriation Tasks (Using all Samples)

	M2	M3	M4	M5	M6	M7	M8	M9	SERIATE
Matrix 2	1.0000								
Matrix 3	.3519	1.0000							
Matrix 4	.2015	.3655	1.0000						
Matrix 5	.2323	.3765	.4237	1.0000					
Matrix 6	.2219	.3259	.4068	.6761	1.0000				
Matrix 7	.2045	.3016	.3145	.5285	.5524	1.0000			
Matrix 8	.2105	.3681	.4281	.5465	.5732	.5228	1.0000		
Matrix 9	.2343	.4400	.4881	.4880	.4844	.4702	.5819	1.0000	
Seriation	.2794	.3853	.2651	.2588	.2686	.2535	.2874	.2884	1.0000

Note. All correlations significant at .05 level.

correlation is significantly larger than zero at the .05 level and in most instances the observed correlation is significant well beyond the .01 level. The magnitude of the observed correlations range up to 0.68, although there are a few correlations that drop below 0.20. Generally, the correlations between performance on the multiple classification tasks are higher than the correlations between performance on the conservation and seriation tasks.

A more formal scale analysis was undertaken using data from the whole sample and then from each sample taken separately. In Table 7-5, Cronbach's alpha for scale reliability is presented for the classification and conservation tasks. Taking all tasks in each set, one finds a rather high coefficient of scale reliability (Cronbach's alpha = 0.8467). Moreover, we find that there is a ^{positive, low to relatively high} strong correlation between performance on each task and overall performance ($r = +0.29$ to $+0.60$), suggesting that the items do provide a reasonably reliable multi-item scale of operational development.

When the analysis is repeated separately for each of the samples and for two different types of tasks (conservation and multiple classification), we obtain similar results with a few exceptions (see Table 7-6). The overall level of scale reliability in all instances except one ranges from $+0.74$ to $+0.84$. The lower values of scale reliability reflect, one suspects, the smaller number of items being used and the smaller sample sizes. The only marked variation in scale reliability is found for the conservation performance of the integrated Turkish sample. For this group the obtained value of Cronbach's alpha

Table 7-5 Scale Analysis using Cronbach's Alpha for Scale Reliability for All Multiple Classification and Conservation Tasks. (Analysis using all children tested in main study, N = 458.)

	Correlation With Total Score	Alpha if Item Deleted
Seriation	.4763	.8383
Conservation of Discontinuous Quantity	.3600	.8433
Conservation of Continuous Quantity	.4108	.8408
Conservation of Weight	.3425	.8446
Conservation of Number (Tower and Cross Problem)	.3224	.8458
Conservation of Number (One-to-One Correspondence)	.4027	.8411
Conservation of Liquid 1	.5573	.8345
Conservation of Liquid 2	.4063	.8409
Conservation of Liquid 3 (Sum and Division)	.2905	.8463
Matrix 2	.3426	.8439
Matrix 3	.4793	.8374
Matrix 4	.4788	.8373
Matrix 5	.5662	.8325
Matrix 6	.5834	.8316
Matrix 7	.5412	.8339
Matrix 8	.6038	.8304
Matrix 9	.5827	.8315
ALPHA WITH ALL ITEMS INCLUDED	-----	.8467

Table 7-6 Cronbach's Alpha for Scale Reliability for Multiple Classification and Conservation Tasks (Computed Separately within each Subsample from Main Study)

SAMPLE	Multiple Classification	Conservation
Mountain Villages	0.8048	0.7400
Coastal Village	0.7507	0.8444
Segregated 0-2 Yrs.	0.8223	0.8080
Segregated 4+ Yrs.	0.8246	0.7781
Integrated	0.7228	0.5919
Germans	0.8284	0.7541

Note. Each task was scored one if child gave correct judgement and an operational explanation; it was scored zero otherwise. Since the data are binary (0 or 1) in form, Cronbach's alpha coefficient (Cronbach, 1950) in this instance is equivalent to the Kuder-Richardson 20 (KR-20) reliability coefficient.

was +0.59 -- a good bit lower than that for other groups although still highly significant. Outside of this one deviation, there is no clear pattern to the results shown in Table 7-6. Overall it appears that performance on each of these tasks was reliably measured, and the results of this psychometric analysis suggests that the items in each of these groups can validly be summed to form a scale of operational performance on the conservation and classification tasks. This, of course, will greatly facilitate hypothesis testing since the dependent variable for inter-group comparisons will be a single score for classification and one for conservation performance rather than a set of ¹⁷~~18~~ dependent variables representing performance on each of individual tasks. Moreover, by virtue of the use of multiple items, the reliability of our inferences will be improved because the effects of random error will be reduced (see Nunnally, 1967).

7.2.3 Regression Analysis

To explore the inter-sample differences in development of conservation and classification skills, let us begin by applying regression techniques to the summary scales derived from our foregoing analysis. (The scales are constructed by simply computing the percent of conservation or classification tasks that were passed by each child, e.g., if child solved 6 of 8 multiple classification problems he was assigned the score of 75%).

The developmental trend (i.e., the relationship between performance and age) for each sample is estimated using regression procedures to obtain the best fitting straight line to

describe the relationship between age and percent of tasks passed. These analyses estimate the equation:

$$(\text{Passing Rate}) = b(\text{Age}) + c$$

where "b" is a coefficient that specifies the slope of the developmental trend and "c" is a constant. The coefficient b specifies the estimated change in percent of tasks passed that is associated with a one year change in age; the constant (c) corresponds to the passing rate predicted at zero years of age (a point of mainly theoretical interest).

The regression coefficients estimated by these analyses are shown in Table 7-7, and they are portrayed graphically in Figure 7-2. The plots shown in Figure 7-2 provide graphic illustrations of the divergences in the results for the conservation and multiple classification tasks. In particular, it will be noted that conservation results produce (largely) overlapping plots with somewhat different orderings of groups in the early and late years. In contrast, there are very substantial differences between the performance of the five groups on the multiple classification tasks and these plots do not intersect. We note, in particular, that the Integrated Turkish sample has a large and consistent advantage in performance. Indeed, even the 7-year-olds in the Integrated sample have an average passing rate of 75 percent (versus 20 to 40 percent for the other samples). Across the various other groups we find that the integrated migrants performance is followed by that of the German children, and then by the Segregated migrants resident 4+ years in Germany, the Segregated migrants resident 0 to 2 years in Germany, and finally by the Non-Migrants.

Table 7-7 Regression Analyses of Effect of Age upon Performance on Multiple Classification and Conservation Tasks

$$\text{Equation: Passing Rate} = b(\text{Age}) + c$$

TASKS and SAMPLE	Effect of Age (b)	Constant (c)	Variance Explained (R ²)
Conservation:			
Mountain Villages	6.77	-2.05	.23
Coastal Village	10.41	-34.28	.36
Segregated 0-2 Yrs.	7.01	-3.26	.23
Segregated 4+ Yrs.	6.05	14.17	.23
Integrated	5.72	8.59	.10
Germans	6.36	-2.31	.16
Multiple Classification			
Mountain Villages	2.46	9.71	.03
Coastal Village	1.86	30.35	.02
Segregated 0-2 Yrs.	5.37	0.73	.08
Segregated 4+ Yrs.	5.57	5.15	.13
Integrated	1.27	66.95	.01
Germans	6.83	1.87	.14

Note. The dependent variable (passing rate) used in these regression analyses was the percent of tasks done correctly by the child. (This is a continuous, equal-interval, variable that is entirely appropriate for regression analysis.)

R² values indicate proportion of total variance in dependent variable (passing rate) that is accounted for by the regression equation; this value can range from 0.0 to 1.0. b coefficients show the increase in passing rates associated with each additional year of age; for example, an estimate of 6.0 would indicate that for each year of age, a child would be expected (on average) to solve 6 percent more of the problems. c is a constant which allows for differences in the overall mean of the groups performance (exclusive of any effects that may be due to differences in the groups' age composition).

The plots of these regression results presented in the accompanying figures should help make clear the nature of these results.

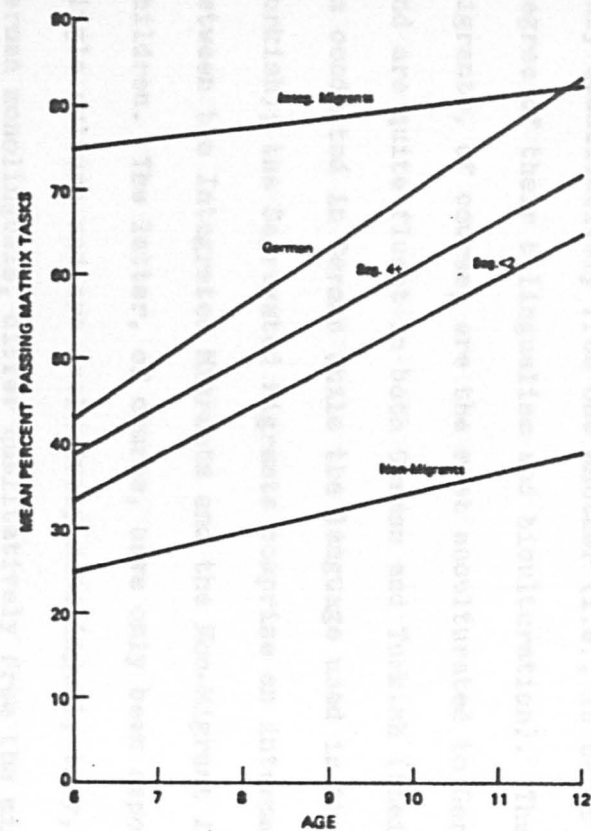
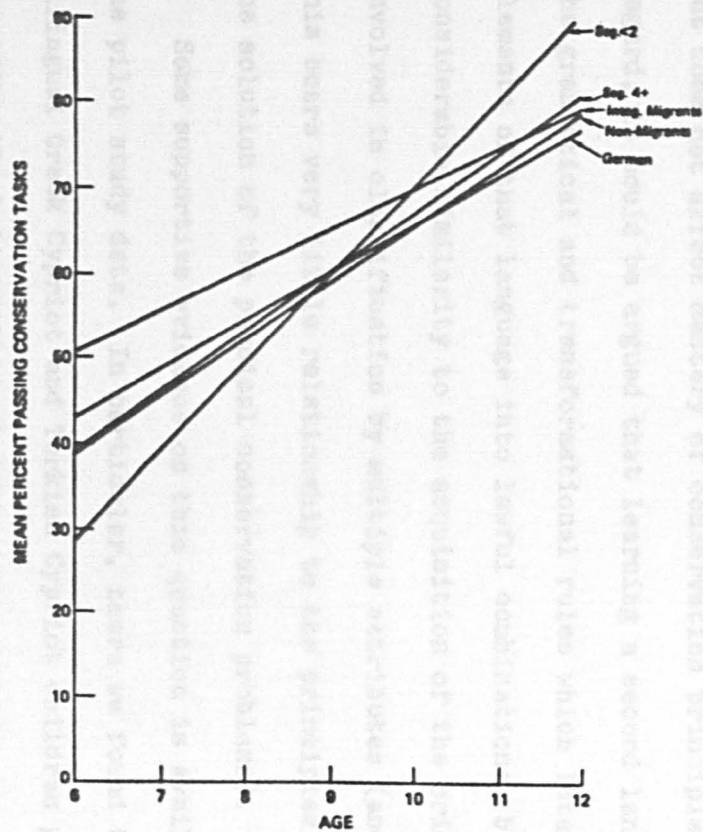


Figure 7-2 Plots of Regression Results for Summary Measures of Multiple Classification and Conservation Performance analysed as a linear function of Age. (Separate estimates were derived for each sample, so slopes of lines were not forced to agree; see Table 7-7 for numerical results.)

In considering these results, the various subgroups of Migrant Turks provide a crucial comparison in that they differ only quantitatively from one another (i.e., in terms of the degree of their bilingualism and biculturation). The integrated migrants, of course, are the most acculturated to German society and are quite fluent in both German and Turkish (their schooling is conducted in German while the language used in their homes is Turkish); the Segregated Migrants comprise an intermediate group between the Integrated Migrants and the Non-Migrant Anatolian children. The latter, of course, have only been exposed to a single culture and are exclusively monolingual; they, like the German monolinguals, differ qualitatively from the migrants.

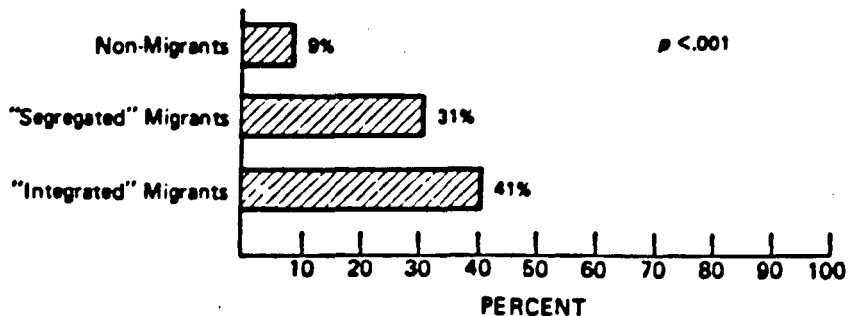
If one were willing to interpret these group differences theoretically, one might argue that bilingualism (or biculturation) affects the acquisition of classification skills but does not affect mastery of conservation principles. In this regard, it could be argued that learning a second language and the grammatical and transformational rules which interrelate elements of that language into lawful combinations, bears considerable similarity to the acquisition of the principles involved in classification by multiple attributes (and, in turn, this bears very little relationship to the principles involved in the solution of the physical conservation problems).

Some supportive evidence on this question is available from the pilot study data. In particular, there we found that the bilingual Greek Cypriot and Turkish Cypriot children performed significantly better than native English children on the multiple classification tasks but performed significantly worse than the

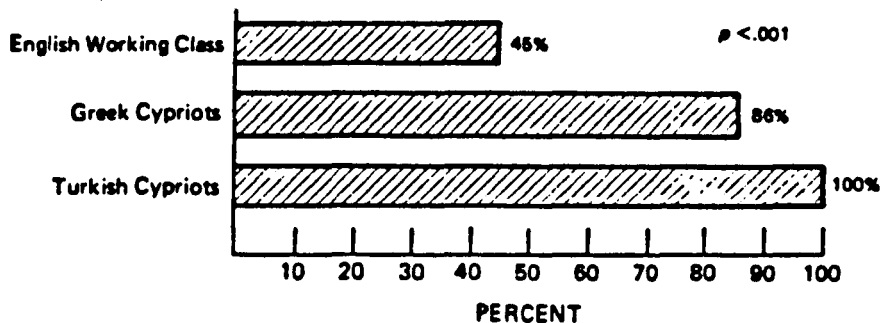
English on the conservation tasks. Since the groups were roughly equivalent in gross economic status and, if anything, one would suspect that native children have educational and social advantages over immigrant groups, the superiority of the Cypriot children on the multiple classification tasks was surprising. Thus, the pilot study data would also support the interpretation that bilingualism alters the sequence of development by speeding up the acquisition of classification skills.

A final source of evidence on this point can be derived from internal analysis of the "inconsistent performers", i.e., children who are operational on the multiple classification problems but are not on the conservation problems or vice versa. For this purpose, we will classify as "operational" children succeeding at five problems in either set. Figure 7-3 displays the proportion of "inconsistent performers" who were operational on the multiple classification (M+) tasks, but not on the conservation (C-) tasks (i.e., M+C-). It will be seen from this tabulation that the proportion of children who display the M+C- pattern increases with the degree of bilingualism/biculturation. Among monolingual Turkish children, 91% of the "inconsistent" performers conserve but have not fully mastered the principles of multiple classification (M-C+); only 9% exhibit the reverse pattern. However, among Segregated Migrants, the proportion of children exhibiting the reverse pattern (M+C-) rises to 31%, and among the Integrated Migrants it rises to 41%.

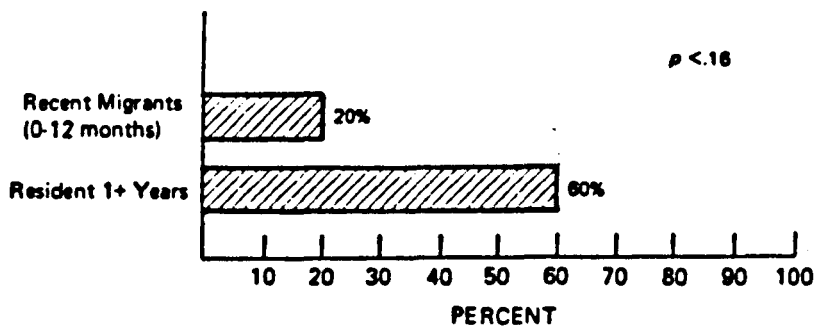
Similar analyses of the data from the pilot study show strong evidence of the same phenomenon. Among the migrant children the vast majority of "inconsistent" performers exhibit a reversal of



1. Study of Turkish migrants to Germany.



2. Study of Cypriots in London.



3. Study of Serbo-Croatian migrants to Australia.

Unpublished data from Heron & Dowell, 1974
 Proportion of Inconsistent Performers who were M+C-

Figure 7-3 ~~Raising Rates on Multiple Classification Problems of Children who Evidenced Mastery of Conservation.~~ (Data from main study, pilot study, and Alastair Heron's study of Serbo-Croatian immigrants to Australia.)

the normal pattern (i.e., 86% of the Greek Cypriot and 100% of the Turkish Cypriot "inconsistent" performers are M+C-). The corresponding rate among the English children was substantially lower (36%).

Some further evidence can be derived from data provided to me by A. Heron from his study of Serbo-Croatian migrants to Australia. Dividing his sample into children who were (a) recent migrants (less than 1 year) and thus, I assume, less bilingual than those who were (b) longer-term residents (1+ years), one finds a similar pattern of results. Among recent migrants, only 1 child in 5 displayed the M+C- pattern, while among the longer-term migrants a majority (6 of 10) of the "inconsistent performers" displayed this pattern. Here, of course, the small sample sizes yields suggestive ($p = .16$) rather than definitive results. We should note, however, that the pattern of findings for this independently tested sample of migrants is perfectly congruent with results obtained in both my own studies of Turkish migrants in England and Germany.

7.2.3a Formal Test. While our regression analyses and the plots shown in Figure 7-2 provide a good demonstration of the intergroup differences in the development of conservation and classification skills, it is possible to provide a firmer basis for our inference. To conduct this test we begin by first fitting a baseline regression model that allows for both linear and nonlinear effects of age. (The variance explained in this analysis is the baseline from which we will subsequently test whether there were inter-sample differences in performance.) The dependent variables are, as before, the summary scores for

classification and conservation performance and the independent variables are (1) age in years and fractions of a year (e.g., 7.33 = 7 years and 4 months), and (2) age squared. This equation was fit using the combined data for all children in our samples.

Subsequently a second equation was fit which also allowed for both linear and nonlinear effects of age, but then introduced terms (so-called dummy variables) to represent each of the samples, thereby allowing us to estimate the inter-sample differences in performance. This procedure results in a comparison of the performance of all other samples' performance to that of a specified reference sample. In the present case we used the Anatolian mountain villagers as the reference sample, and the multiple regression procedure estimated differences in performance for each of the other samples from the performance of this reference group. (It is for this reason that the entry under inter-group difference for the Mountain Village sample in Table 7-8 is zero; by definition, the Mountain village performed the same as the reference group -- since it was the reference group.)

Table 7-8 presents the results of these analysis for both the conservation (plus seriation) tasks and for the multiple classification tasks. This table presents estimates derived from an analysis that included estimates for inter-sample differences in performance. It also shows the proportion of variance explained by a baseline model that only takes into account the linear and nonlinear effects of age (but ignores inter-sample differences).

It will be seen from Table 7-8 that an analysis excluding the

Table 7-8 Multiple Regression Analysis of Performance on Conservation and Multiple Classification Scales as a function of Age (linear and squared) and Origin of Sample

TASK & VARIABLE	Coefficient Estimated (B)	Standard Error	T Value	P
<u>Conservation</u>				
Age (Linear)	9.78769	2.56127	3.821	.0002
Age (Squared)	-.13164	.11566	1.138	.2557
Transitional Village	-2.51783	5.00566	.503	.6152
Segregated, 0-2 Years	4.26698	3.77145	1.131	.2585
Segregated, 4+ Years	1.95426	3.68060	.531	.5957
Integrated	8.79114	3.36603	2.612	.0093
German	.20259	3.63022	.056	.9555
(Constant)	-17.34425	13.56923	1.278	.2019
R^2 (Excluding samples)	0.22887 (a)			
R^2 (Including samples)	0.24434 (b)			
<u>Multiple Classification</u>				
Age (Linear)	-2.31519	2.85612	.811	.4180
Age (Squared)	.26655	.12898	2.067	.0394
Transitional Village	15.12306	5.58192	2.709	.0070
Segregated, 0-2 Years	21.39011	4.20562	5.086	.0000
Segregated, 4+ Years	27.69154	4.10432	6.747	.0000
Integrated	43.44146	3.75353	11.573	.0000
German	35.68775	4.04814	8.816	.0000
(Constant)	26.71797	15.13135	1.766	.0781
R^2 (Excluding samples)	0.06531 (c)			
R^2 (Including samples)	0.33010 (d)			

Note. B coefficients for sample variables show deviation of performance of each sample's performance (in percentage points passing) from performance of the Anatolian Mountain Village sample (baseline sample). So, for example, a B coefficient of 43.44 for the Integrated sample on the multiple classification tasks indicates that, on average, children in this sample gave correct answers to 44 percent more classification problems than children (of the same age) in the Anatolian Mountain Village sample. The standard errors for these B coefficients can be used to establish confidence intervals around these estimates. For example, the standard error of 3.75 for same finding can be multiplied by ~~two~~ ^{1.96} to give an approximate 95 percent confidence interval for the estimate. i.e., 43.44 plus or minus 7.5 percentage points is the 95 percent confidence interval for the estimate of the difference (controlling Age and Age Squared) between the performance of the integrated sample and the performance of the mountain village sample on the multiple classification tasks.

(a) $F = 65.296$, $df = 2/440$, p less than .001

(b) $F = 20.094$, $df = 7/435$, p less than .001

(c) $F = 15.372$, $df = 2/440$, p less than .001

(d) $F = 30.622$, $df = 7/435$, p less than .001

intersample differences accounts for almost 23 percent of the variance in conservation performance for the entire sample, but only 6.5 percent of the variance in multiple classification performance. When intersample differences in performance are added into the analysis, our ability to account for the variance (R^2) in multiple classification performance jumps to 33 percent (from 6.5). However, allowing for intersample differences has only a negligible impact on our ability to account for the variability in children's performance on the conservation (and seriation) tasks: explained variance (R^2) increases slightly, from 22.9 to 24.4 percent.

Overall, we can conduct a formal test of the inter-sample differences by comparing these results, i.e., the variance explained with and without the dummy variables accounting for the samples. (See Cohen and Cohen, 1975, pp. 135-137 for a description of the relevant procedures.) Conducting such a test we obtain $F = 34.6$, $df = 5/438$ for the multiple classification results. This result indicates that the intergroup differences are significant at the .001 level. For the conservation results, the same test yields, $F = 1.79$, $d.f. = 5/438$, which is not significant at the .05 level.

This result is consistent with the inference that the eye would draw from the plots shown Figures 7-2a and 7-2b. That is, there do not seem to be large differences across samples in performance on the conservation and seriation problems. Most of the variability appears to occur through a common maturational process, i.e., in all samples there are consistent and relatively large changes in performance occurring as children grow older but

there are only relatively small differences between the performance of each sample at any given age. And, indeed, the only significant intersample difference is found for the integrated migrants who, on average, solve 8.79 percent more conservation problems than mountain village children of the same age. In addition, we note that the insignificant t-value (1.14) for the non-linear Age term (Age-Squared) used in this regression analysis indicates that conservation performance shows a roughly linear developmental trend.

However, on the multiple classification tasks, the intersample differences are large, and they account for a substantial portion of the variance in the data. While age (linear and nonlinear) can account for only 6.⁵ percent of the variation in children's performance on the multiple classification tasks, adding intersample differences into the analysis allows us to account for 26.³³ percent of the variance in performance. And, as expected, the coefficients for each of the samples has a significant t-value -- indicating a significant difference between the performance of each sample and that of the baseline group (Anatolian Mountain Villagers) (Interestingly, we also note that the equation estimates indicate that the developmental trend in the classification data is significantly non-linear; the age squared coefficient is significantly different from zero with p less than .05, while the linear term is not significantly different from zero.)

Since the coefficients for intersample differences (controlling for linear and nonlinear age effects) represent the purest estimate available of the effects of bilingualism and

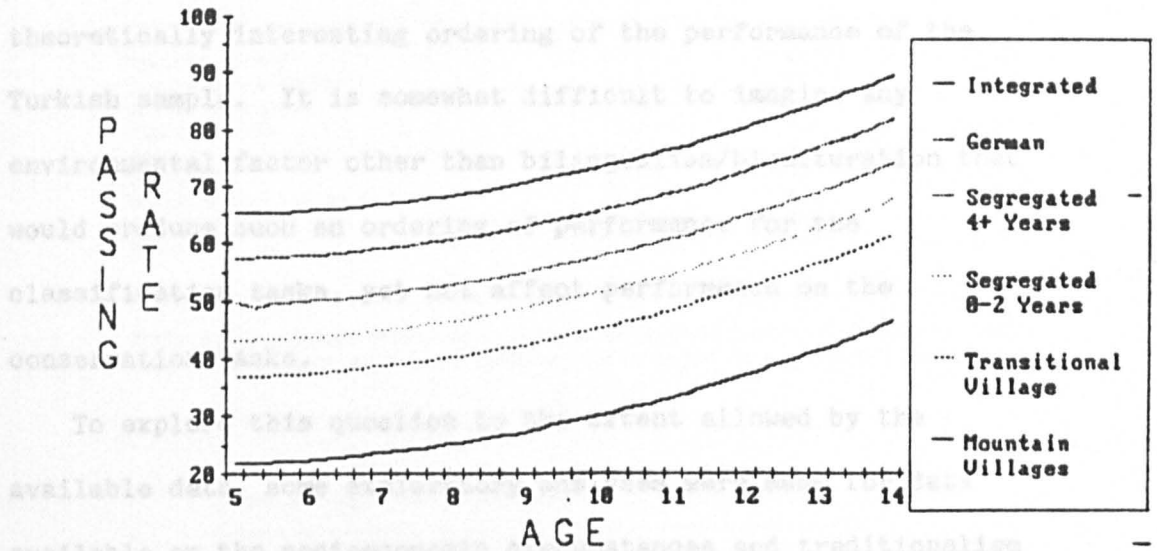
biculturation, they have been graphically illustrated in Figure 7-4. It will be seen from this figure and from the coefficients shown in Table 7-8 that the results for multiple classification performance follow exactly the pattern that would be predicted by the hypothesis that bilingualism and biculturation accelerate performance on the classification tasks. For each of the migrant groups, the advantage is greater with the degree of bilingualism and biculturation.

(For the ^{three}~~two~~ monolingual and monocultural groups, we find that (1) children in the transitional village do, indeed, perform significantly better on the classification tasks than children from the mountain villages ($t = 2.709$, $p < .0001$); and (2) German children perform better than most of the migrant groups but their performance is surpassed by that of the integrated Turkish Migrants.)

7.2.3b Sociocultural Factors. Given this result it may naturally be asked whether there are any other differences between the samples (other than age, bilingualism, and biculturation) that might help to explain this pattern of results. At the outset, we would observe that this pattern of results is somewhat difficult to account for by environmental factors. Theories of cognitive deficit, environmental deficiency, and so forth would seem easiest to support if there were a demonstration of a general retardation of cognitive development in some groups for both conservation and multiple classification performance.

The foregoing findings, however, show few differences between the groups on the conservation and seriation tasks (save for a

Multiple Classification



Conservation

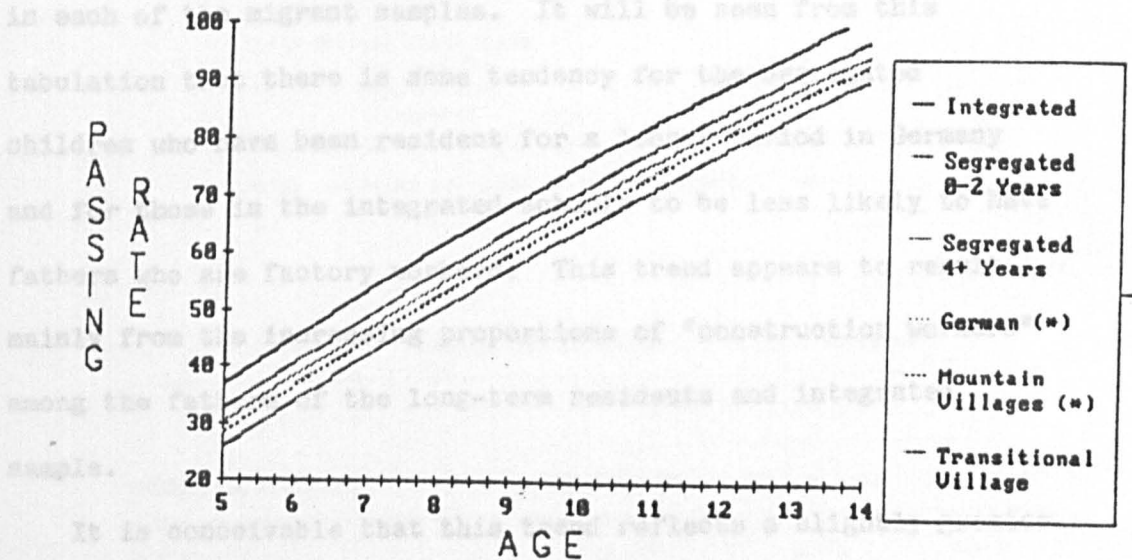


Figure 7-4 Plots of Regression Results for Summary Measures of Multiple Classification and Conservation Performance analysed as a function of Age, Age Squared, and Sample. (Note that, unlike Figure 7-2, this analysis estimated a unitary developmental effect [i.e., a common age effect for all samples]; thus the plots for each sample were constrained to be parallel to one another.)

(*) Conservation results for Mountain Village sample and German Sample differed by only 0.20259 percentage points, hence the conservation plots for these two groups overlap in the bottom figure.

modest advantage of one group: the Integrated Migrants), while for the multiple classification tasks there is a clear and theoretically interesting ordering of the performance of the Turkish sample. It is somewhat difficult to imagine any environmental factor other than bilingualism/biculturation that would produce such an ordering of performance for the classification tasks, yet not affect performance on the conservation tasks.

To explore this question to the extent allowed by the available data, some exploratory analyses were made for data available on the socioeconomic circumstances and traditionalism of the migrant families in the sample. Table 7-9a displays the distributions of the occupations of the fathers of the children in each of the migrant samples. It will be seen from this tabulation that there is some tendency for the segregated children who have been resident for a longer period in Germany and for those in the integrated schools to be less likely to have fathers who are factory workers. This trend appears to result mainly from the increasing proportions of "construction workers" among the fathers of the long-term residents and integrated sample.

It is conceivable that this trend reflects a slightly greater integration of the fathers in these samples into mainstream German life. To the extent that construction work may inherently require more social interaction and thus superior communication skills to those required by assembly line work, this might be taken as an indicator of the greater integration of the families of these children into their host culture. Indeed, it is quite

Table 7-9a Occupations of Fathers of Migrant Children

OCCUPATION	S A M P L E		
	Seg. 0-2 Yrs.	Seg. 4+ Yrs.	Integrated
Factory Worker	66.7%	58.2%	47.4%
Construction Worker	7.7	10.9	22.8
Waiter or busboy	1.3	7.3	7.0
Civil Servant	2.6	1.8	5.3
Shopkeeper or Small Businessman	2.6	1.8	0.0
Carpenter	3.6	1.8	1.3
Building Cleaner or Dustman	7.3	0.0	9.0
Gardener	5.5	7.0	3.8
Other	2.7	13.0	3.4

NOTE: Any occupation mentioned for three or more fathers was included in this compilation; those with fewer mentions are reported in the "other" category.

Table 7-9b Religious Practices of Migrant Samples

PRACTICE and SAMPLE	Percent Reporting Practice
Fasting by Parents	
Seg. 0-2 Yrs.	96.7
Seg. 4+ Yrs.	92.1
Integrated	87.5
Child Attends Koran class	
Seg. 0-2 Yrs.	15.6%
Seg. 4+ Yrs.	12.8
Integrated	17.1

NOTE: Question not asked of young children in sample.

Table 7-9c Occupational Aspirations of Migrant Children

OCCUPATION ASPIRED TO	S A M P L E		
	Seg. 0-2 Yrs.	Seg. 4+ Yrs.	Integrated
Doctor	37.5%	37.5%	32.5%
Engineer	1.8	1.8	8.8
Teacher	21.4	8.9	13.8
Airplane Pilot	0.0	3.6	8.8
Secretary or Stewardess	0.0	1.8	5.0
Nurse	1.8	3.6	0.0
Police Officer	1.8	3.6	0.0
Tailor	1.8	7.1	2.5
TV or Electronic technician	1.8	0.0	3.8
Hairdresser	0.0	5.4	1.3
Civil Servant	3.6	3.6	1.3
Military Officer	3.6	1.8	2.5
Other or Don't Know	14.3	10.7	7.5

NOTE: All occupations mentioned by 3 or more children are included. Occupations mentioned by only one or two children are included in the "other" category. Question not asked of young children in sample.

sensible to believe that families who have been resident for longer periods of time in Germany (i.e., both the Segregated 4+ year sample and the Integrated sample) would show slightly more integration of family members into the host economy.

Nonetheless, one should not lose sight of the fact that, overall, most fathers in every migrant sample were employed in very similar occupations -- with factory work being the predominant type of employment.

As a measure of attachment to the culture of their origin, religious practices can provide a potentially sensitive indicator of acculturation. Virtually all villagers in Anatolian Turkey follow the practice of fasting during the Islamic month of Ramadan. The extent to which this practice is abandoned in the host culture (which provides less social sanction for breaking the fast), can be taken as an indicator of the extent to which a family has abandoned the traditional practices of their culture of origin.

Table 7-9b tabulates the proportions of children who report that their parents fast during Ramadan. It will be seen from this tabulation that the overwhelming majority of parents are reported to fast (between 87 and 97 percent). However, there are some differences across samples, and these differences follow those observed in the parental occupations. The parents of the integrated sample are less likely to fast than those of long-term segregated migrants, who in turn are less likely to fast than the short-term segregated migrants.

While this may be taken as an indicator of the declining state of traditional religious practices across these groups, the

picture is not consistent with another indicator: attendance of children at Koran classes. For this indicator, we do not find any consistent trend. Indeed, the overall level of attendance is quite low (13 to 17 percent), which may reflect the relative unavailability of such classes (or the difficulty of arranging attendance).

Finally, for the migrant children themselves, we do have data on the sorts of occupations they aspired to. To the extent that children have adjusted their aspirations to reflect the new opportunities available in their host culture, we might say they were more acculturated. It will be seen, however, from Table 7-9c that there were no consistent differences across the migrant groups. The only massive difference was that the short-term segregated migrants were more likely to say they wanted to be school teachers. Some other small differences can also be observed, e.g., 8.8 percent of the integrated children said they wanted to become engineers versus 1.8 percent of the other samples.

While it is hard to believe that such factors could play a strong role in accounting for the observed differences in cognitive performance of the children, some empirical tests can be undertaken. To conduct this analysis we begin by looking solely at the migrant samples, and among those at children aged 8 years and over (since questionnaire data were not obtained from younger children). It is then possible to identify in this sample

1. children whose parents have given up fasting (and who thus might be less traditional);

2. children who have attended Koran classes in Germany (and who thus might be more traditional);
3. children whose fathers have moved into construction work (and who thus might be better integrated into their host culture); and
4. children who aspire to professional/technical occupations such as Physician, Engineer, and Teacher).

To perform this analysis we re-estimate the regression equations used in Table 7-8 but now we introduce additional "dummy" variables that take the values zero (for No) or one (for Yes) to indicate whether or not the child's parents fasted, whether the children had attended Koran class in Germany, whether their fathers were construction workers, and whether they aspired to an elite occupation. (Specifically, the occupations of: physician, engineer, scientist, airline pilot, school principal, journalist, or translator. School teacher was not coded as an elite occupation because this is a familiar occupation to the children even in the mountain villages. In contrast, school principal was a more "novel" occupation peculiar to societies more complex than that of the rural village.) Finally, to allow for possible sex stereotyping in childrearing, we also included a variable indicating whether the child was female.

Our analysis asks two questions. The first question is:

Does the addition of these socio-environmental variables significantly improve our ability to account for differences between children in their performance on the conservation and multiple classification tasks?

To answer this question we compare the variance explained by an analysis that includes these factors to the variance explained by

an analysis that excludes them. (The procedure is exactly the same as that used to determine if there were inter-sample differences in performance that persisted after age was controlled.)

The second question posed by our analysis is:

When we control for such factors, do the inter-sample differences in performance disappear (or change in some other significant manner)?

To answer this question we contrast the estimates of the inter-sample differences that are obtained when these factors are controlled to those that are obtained when such factors are ignored.

Table 7-10 presents the relevant results. These results, it must be realized, are based on a much smaller sample than that of our previous analyses. The present analysis is restricted to migrant children aged eight and older (younger children were not given the questionnaire.) It will be seen from the results presented in Table 7-10 that incorporating our socio-cultural factors into the regression analysis had only a very modest impact on our ability to account for differences in children's cognitive performance. Specifically, the variance accounted for (R^2) by an analysis ignoring these sociocultural factors is 31.6% for conservation performance and 21.0% for multiple classification, controlling for these factors in our analysis raises R^2 only slightly to: 32.7% and 23.1% respectively.) Moreover, the pattern of inter-sample differences in performance is virtually unchanged when we incorporate such factors in our analysis. For the conservation tasks the coefficients for

Table 7-10a Estimates for Multiple Regression Equation predicting Conservation Performance as Function of Age, Fathers Occupation, Religious Practice, and Subsample

	Coefficient Estimated (B)	Standard Error	T-value(g)
<u>Age</u>			
Age (Years)	7.953194	5.16223	1.541
Age Squared	-0.014338	0.23090	0.062
<u>Socio-Cultural Factor (b)</u>			
Female	-6.375229	4.74758	1.343
Attend Koran Class	5.778535	5.50103	1.050
Parents Fast	1.215561	8.57810	0.142
Father's Occupation "Integrated"	1.504385	5.89942	0.255
Aspire to Elite Job	6.140217	4.77215	1.287
<u>Sample Differences (g)</u>			
Segregated, 4+ Years	-2.982220	6.16626	0.484
Integrated	3.927252	5.79169	0.678
(Constant)	-10.61153		
R ² (without Sociocultural Factors)	0.31632 (d)		
R ² (with Sociocultural Factors)	0.32705 (e)		

Table 7-10b Estimates for Multiple Regression Equation predicting Performance on Multiple Classification Tasks as function of Age, Fathers Occupation, Religious Practice, and Subsample.

	B	Standard Error	T-value (g)
<u>Age</u>			
Age (Years)	-0.7771793	6.13455	0.127
Age Squared	0.2246052	0.27439	0.819
<u>Socio-Cultural Factor (b)</u>			
Female	2.963047	5.64180	0.525
Attend Koran Class	3.863216	6.53716	0.591
Parents Fast	1.746324	10.19381	0.171
Father's Occupation "Integrated"	3.646850	7.01059	0.520
Aspire to Elite Job	7.743521	5.67100	1.365
<u>Sample Differences (g)</u>			
Segregated, 4+ Years	5.694692	7.32769	0.777
Integrated	22.55371	6.88257	3.277
(Constant)	30.31857		
R ² (without Sociocultural Factors)	0.210 (f)		
R ² (with Sociocultural Factors)	0.231 (g)		

(a) T-test statistic indicates whether estimate of B coefficient is reliably different from zero. If T-value exceeds 1.96, the null hypothesis (that coefficient is zero) can be rejected at .05 level; if T-value exceeds 2.55 null hypothesis can be rejected at .01 level.

(b) Socio-Cultural Factors are intended to indicate aspects of the adaptation of the child and his family to German culture, i.e., the extent to which they have come to adopt attitudes and practices of the new culture and break with the practices of their culture of origin. (Gender is also included to allow examination of possible sex stereotyping of child rearing.) These factors are represented as dummy variables in the regression equation (i.e., variable that have only two possible values: zero or one). The coefficients for these values estimate the percentage point difference in average passing rates for persons who have specified trait (coded 1) versus those who do not (coded 0).

Variables were defined as follows. Female: coded 1 if child was female, zero if male. Attend Koran Class: coded 1 if child reported attending Koran classes in Germany. Parents Fast: coded 1 if child reported that either parent did not practice fasting during Ramadan; coded zero otherwise. Father's Occupation integrated was intended to indicate whether the child's father worked outside of the traditional factory labor occupation characteristic of new migrant laborers. This variable was coded 1 if the child reported that father's occupation was employed in construction, or worked as a painter, wallpaper hanger, electrician, carpenter or civil servant; coded zero otherwise. Aspire to elite job was coded 1 if the child's first choice for a job was a high status, nontraditional job (specifically: physician, engineer, scientist, airline pilot, school principal, journalist or translator; coded zero otherwise.

(g) Sample differences are estimated using dummy variables to represent which sample the child is drawn from. The baseline category for this comparison is the short-term migrant sample; they have a "zero" difference, and the performance of the other group is shown as a positive or negative difference from the performance of the short-term migrant group. (In estimating the equation dummy variables were entered for groups other than the baseline group, i.e., one dummy variable coded 1 is the child was from the long-term segregated group, and another dummy variable coded 1 if the child was from the integrated sample.)

intersample differences in performance are both insubstantial and statistically insignificant. However, on the multiple classification tasks the familiar pattern emerges. The integrated sample evidences a highly significant ($p < .01$) 22 percentage point superiority in their multiple classification performance, controlling for the impact of both linear and nonlinear Age effects, sex, and our four sociocultural factors. And the long-term segregated migrants perform at a level which is somewhat superior to the short-term migrants (5.7 percentage points) but inferior to the performance of the integrated migrants. (Due to the small sample size in this analysis, the result for long-term segregated migrant is not statistically significant.)

7.2.4 Summary

The preceding analyses have investigated in some detail the cross-cultural differences in children's operational performance. Overall, this analysis has consistently demonstrated small and statistically weak differences between the performance of the samples on conservation tasks. Analyses of a summary measure of conservation and seriation performance indicated that most of the groups turned in statistically equivalent performances (after linear and nonlinear age effects were controlled). On multiple classification problems, however, our analysis of the Turkish samples consistently indicated cross-cultural differences in performance that mirror the degree of bilingualism and biculturation of our four major Turkish samples (i.e., Non-migrant, short-term segregated migrants, long-term segregated

migrants, Integrated migrants). This finding that was evident in simple tabulations shown in the very first table in this chapter (Table 7-1) persisted when multi-item scales were constructed, when linear and nonlinear age effects were controlled, and when available indicators of other sociocultural factors were incorporated into our analysis.

Results for two special monolingual and monocultural samples (German and transitional village children) suggest that beyond the effects of bilingualism and biculturation, there do appear to be differences that could be attributed to other environmental factors, e.g., exposure to more complex societies. Thus the German children's performance on the classification tasks was more advanced than that of all migrant groups except the integrated sample. Furthermore, the children from the transitional village sample outperformed the children from the more isolated mountain villages.

7.3 EFFECT OF USING JUDGEMENT-ONLY CRITERION IN ASSESSING CHILDREN'S PERFORMANCE

As discussed in the previous chapter, the nature of this research together with the debate that exists in the literature led us to consider alternative methods of scoring the Piagetian tasks. There are two common ways of scoring the Piagetian tasks. The traditional way follows Piaget's methode clinique and treats the children as operational on a task only if they (1) make the correct judgement, (2) give an operational explanation to justify their judgement, and (3) persevere in their judgement when asked a follow-up question (e.g., Would any picture other than the one

you chose fit as well in the matrix?). Piaget argues that this three-fold procedure helps insure that the classification of the child's performance on the task truly reflect operational thinking -- rather than random guessing.

The alternative scoring method uses only the child's judgement in classifying the child's performance. The claimed theoretical advantage of this scoring procedure is that it does not confound the child's verbal proficiency with the measurement of his level of thought. Of course, this procedure will erroneously classify as "operational" children who happen to guess the correct answer to a given task. However, over a large number of tasks, it might be assumed that guessing would produce a much lower level of success, and so a summary score (e.g., adding up the number of correct answers) would provide a reliable guide to the child's level of development.

In scoring the data from both the pilot and main study, we have used the three-fold judgement criteria. It is however of interest to know how different the results would have been if we had used the judgement only criterion. To investigate this, we re-scored all of the tasks for all children in the study using the judgement-only criterion. (Since full details of the children's judgements, explanations, etc. were initially coded, this re-scoring is accomplished with a minor change to the computer specifications used in the analysis.)

Overall, there was a very high correlation between the summary scores obtained under the two methods (see Table 7-11 for correlations for individual tasks). For the summary measures used in the regression and other analyses in this chapter, there

Table 7-11 Correlations between Scores Obtained when Tasks are
Scored Using Judgement Criterion versus Judgement plus
Explanation Criterion

SUMMARY SCORE: Conservation	0.9049
SUMMARY SCORE: Multiple Classification	0.9295
Conservation of Continuous Quantity (Solid)	0.6673
Conservation of Weight	0.8327
Conservation of Discontinuous Quantity	0.8956
Conservation of Number (Tower and Cross)	0.8854
Conservation of Number (one-to-one)	0.8251
Conservation of Distance and Time	0.8571
Conservation of Liquid 1	0.8226
Conservation of Liquid 2	0.9038
Conservation of Liquid 3 (Sum & Division)	0.5753
Matrix 2	0.6270
Matrix 3	0.9120
Matrix 4	0.9318
Matrix 5	0.8057
Matrix 6	0.7637
Matrix 7	0.7531
Matrix 8	0.7606
Matrix 9	0.9198

was a correlation of $+0.9049$ between the judgement-only versus judgement plus explanation scoring of the conservation tasks, and a correlation of $+0.9295$ between the alternative scorings for the multiple classification tasks. For individual tasks, the correlations were somewhat lower, ranging from 0.57 to 0.92.

Given these high levels of correlation, it is obvious that the results of our analyses are unlikely to be altered by the use of one or the other of the scoring criteria. As an illustration of this fact, Table 7-12 shows a breakdown for children aged eight to eleven of performance on the conservation and classification tasks. This breakdown shows the result obtained when the summary score is constructed using a judgement only scoring criterion versus a judgement plus explanation scoring criterion. As would be expected, the judgement plus explanation criterion produces somewhat lower levels of passing. This occurs because some children make the correct judgement but do not give an operational explanation. Thus we note, for example, that the passing rate on conservation tasks for mountain village children aged 8 to 9 is 73.3% using the judgement criterion but it drops to 63.8% when we score the tasks using explanations plus judgements. Despite such changes, it can be seen that the two scoring produce similar orderings of the various groups on the tasks. For example, on the multiple classification tasks the integrated children excel while the mountain village children lag behind under either scoring scheme.

The high correlations between the alternate scoring methods and the similarity of the results obtained using these two methods gives us some confidence in the reliability of our

TABLE 7-12 Average Passing Rates for Children Aged 8 through 11 on Conservation and Multiple Classification Tasks Using Judgement-Only and Judgement-plus-Explanation as Scoring Criteria.

TASK and SAMPLE	PASSING RATE	
	Judgement Only	Judgement plus Explanation
CONSERVATION		
<u>Age 8 to 9</u>		
Mountain Villages	73.3%	63.8%
Coastal Village	77.1	65.7
Segregated 0-2 Yrs.	65.5	59.6
Segregated 4+ Yrs.	65.8	62.6
Integrated	68.3	62.3
Germans	68.0	65.3
<u>Age 10 to 11</u>		
Mountain Villages	80.8	77.1
Coastal Village	77.1	68.5
Segregated 0-2 Yrs.	82.6	77.0
Segregated 4+ Yrs.	78.9	76.1
Integrated	86.2	84.6
Germans	74.8	68.9
MULTIPLE CLASSIFICATION		
<u>Age 8 to 9</u>		
Mountain Villages	42.5	31.9
Coastal Village	66.2	48.7
Segregated 0-2 Yrs.	62.5	55.8
Segregated 4+ Yrs.	62.5	52.7
Integrated	82.6	80.4
Germans	68.4	66.0
<u>Age 10 to 11</u>		
Mountain Villages	48.5	38.7
Coastal Village	66.2	56.2
Segregated 0-2 Yrs.	70.8	57.8
Segregated 4+ Yrs.	78.4	74.4
Integrated	82.5	81.6
Germans	82.7	78.8

testing procedures and the validity of our data.

7.4 STRUCTURE OF DEVELOPMENT

In section 7.2 we considered the first of our questions about cross-cultural differences in cognitive development, that was: Is there a difference across cultures in the levels of development attained at different ages? In the present section we consider our second question: Are there differences across cultures in the sequence in which children acquire operational skills? Obviously our consideration of this question is constrained by the available data. All of our analysis must focus upon the 18 tests of concrete operational development used in the main study.

We will proceed in our analysis of this question from an initial unidimensional approach (Guttman scaling using scalogram analysis) to multidimensional approaches using nonmetric multidimensional scaling. In each case our basic question is whether the patterns of association or orderings of development obtained from each of our samples was equivalent.

7.4.1 Scalogram Analysis. Our first attempt to study the structure of the children's performance on the conservation and classification tasks used the procedures of scalogram analysis which is sometimes referred to as Guttman scaling. Scalogram analysis attempts to discover an underlying unidimensional order to the "difficulty" of a given set of tasks or test items. This procedure is optimal for instances where success on one task is a prerequisite for competent performance of a second task. Simple examples of such tasks involving human development include such things as ability to crawl and ability to walk. In almost all

instances children first master the skills required for crawling and then learn to walk.

Scalogram analysis has been shown to be a useful procedure for studying cognitive development at the concrete operations stage by Versey (1978). He notes that this procedure can be particularly appropriate for the analysis of such data because:

As there are no normative assumptions other than a monotonic relationship between items, this method lends itself to the analysis of responses to cognitive tasks where a sequential developmental pattern is postulated. If the analysis reveals a scalable set of tasks this would suggest a hierarchy of difficulty where tasks correctly responded to in scale order presupposes that tasks lower in the hierarchy have been correctly answered. (p. 71)

Versey reports two findings that are particularly important for our own analyses. First, in repeated scalogram analyses of a sample of the same children tested four times at six month intervals (starting at roughly age 6), he found that the hierarchies of difficulty "were significantly stable from testing to testing in respect to both items and subjects in the sample" (p. 71, emphasis in original). This result indicates that the Piagetian tasks do have a rather reliable difficulty structure. However, Versey also found that "the tasks are not fully scalable at each testing if the coefficients of reproducibility are considered" (p. 77). The latter result suggests that the scalogram analysis' assumption of a unidimensional structure of "cognitive" or "operational" difficulty may be incorrect. (This finding is similar to our own results using scalogram analysis in the pilot study.)

The essential prerequisite for a successful Guttman scale is that individuals who successfully perform one task also have successfully performed all other tasks that are specified as

"less difficult." The procedure for establishing the ordering of the task difficulties, however, does not involve any predetermined order, but rather the difficulty ordering emerges from the scalogram analysis. The suitability of a given set of items for Guttman scaling is judged at the end of the process by studying the incidence of "scale errors," i.e., the instances in which a child failed a simpler task but passed a more difficult one. (For our simple example, an error would occur when a child learned to walk without having learned to crawl.)

Guttman scaling analyses were carried out separately for the multiple classification tasks and the conservation items, and performance was analyzed both for all subjects taken together and then for each sample taken separately. Tables 7-13a and 7-13b presents the results of this exercise. It will be seen from these tables that there was some general agreement in the patterns of task difficulty that emerged from these analyses. For example, the conservation of distance and time task was found to be one of the most difficult tasks (ranked 1 or 2 by all subgroups) while the first conservation of liquid task (pouring into tall skinny container) was found to be among the least difficult (ranked between seventh and tenth in all subgroups). In the middle range, there was greater variability, and there were one or two instances in which the inferred difficulty of a task varies greatly. Most notably, the conservation of liquid after sum and division was found to be the most difficult task for the German youth, while it was one of the easiest for all other groups (ranked seventh to tenth). Although there is no way to be sure, one must be suspicious of this result since it

TABLE 7-13₁ Guttman Scaling of Conservation and Seriation Tasks

TASKS	All Samples	German	Integ. Migrants	Segreg. 4+ Yrs	Segreg. 0-2 Yrs	Transit. Villages	Mountain Villages
Distance and Time (DT)	1	2	1	2	2	1	1
Number 1 (Tower & Cross)	2	5	2	1	1	5	2
Weight	3	3	3	4	4	2	3
Continuous Quantity	4	9	4	4	5	3	5
Number 2 (1 to 1 corresp.)	5	7	5	7	7	6	4
Discontinuous Quantity	6	6	6	3	3	9	6
Liquid 2	7	4	8	6	6	4	7
Sum and Division of Liquid	8	1	7	8	8	10	9
Seriation	9	10	10	10	10	8	8
Liquid 1	10	8	9	9	9	7	10
Coefficient of Reproducibility	.79	.79	.83	.81	.82	.81	.77

TABLE 7-13₂ Guttman Scaling of Multiple Classification Tasks

TASKS	All Samples	German	Integ. Migrants	Segreg. 4+ Yrs	Segreg. 0-2 Yrs	Transit. Villages	Mountain Villages
Matrix 7	1	3	2	1	1	5	6
Matrix 6	2	1	1	2	4	4	4
Matrix 8	3	2	4	3	2	3	2
Matrix 5	4	4	3	4	3	6	5
Matrix 9	5	5	5	5	5	2	3
Matrix 4	6	6	6	6	6	1	1
Matrix 3	7	7	7	7	7	7	7
Matrix 2	8	8	8	8	8	8	8
Coefficient of Reproducibility	.85	.87	.88	.86	.86	.82	.88

Notes. Numbers above show ranking of task when Guttman scale analysis was performed for all children tested in main study (see column labelled "All Samples") and then when the analyses were repeated separately for each group. Tasks are ranked in order of difficulty: (1) signifies the most difficult of the task, and (8) signifies the least difficult.

The unschooled female sample was only administered the conservation and seriation tasks, so they are not included in this analysis of multiple classification performance.

involves the only sample in which all testing was done by a tester other than the author. (The tester was a German Ph.D. candidate in cognitive developmental studies.) This result may have been due to some variation in the tester's procedures for administering the tasks or recording the results.

For the multiple classification matrices (see Table 7-13b) we also find considerable similarities in the orderings of task difficulty, but here again we find some noteworthy divergences. The divergences, however, all involve the Anatolian children who found one of the matrices (Matrix 4) to be unusually difficult compared to other samples. (This matrix ranked most difficult for both the Mountain and Transitional village samples.) In contrast, Matrix 7 was found to be relatively easy (ranked 5th and 6th most difficult for the Anatolian samples, compared to its ranking as 1st or 2nd most difficult matrix for the other samples).

To assess the similarity that exists between the orderings of task difficulty produced by different samples, Table 7-14 presents rank order correlations between the difficulty orderings obtained for each sample. It will be seen that for the multiple classification tasks there are relatively high correlations (0.8 to 0.9) between the difficulty orderings for all samples resident in Germany (German children and both Integrated and Segregated Turkish Children) and there is also a relatively high level of correlation between the orderings produced by the two Anatolian groups (0.7). However the level of correlation between these two groups (i.e., samples resident in Germany versus samples resident in Turkey) is considerably lower (0.2 to 0.4).

TABLE 7-14 Rank Order Correlations between Orderings of Task Difficulty derived from Guttman Scaling of Results for Total Sample and Each Subsample taken Separately.

TASKS and SAMPLES	ALL Samples	German	Integ. Migrants	Segreg. 4+ Yrs	Segreg. 0-2 Yrs	Transit. Villages	Mountain Villages
<u>Multiple Classification Matrices</u>							
German	.9286*						
Integrated Migrants	.9524*	.9286*					
Segregated Migrants, 4+ Years	1.0000*	.9286*	.9524*				
Segregated Migrants, 0-2 Years	.9286*	.8333*	.8333*	.9286*			
Transitional Village	.3095	.3810	.2619	.3095	.2657		
Mountain Villages	.2657	.4286	.2619	.2657	.3095	.9524*	—
<u>Conservation and Seriation</u>							
German	.3818						
Integrated Migrants	.9758*	.4424					
Segregated Migrants, 4+ Years	.8754*	.3830	.8632*				
Segregated Migrants, 0-2 Years	.8788*	.4182	.8667*	.9970*			
Transitional Village	.7333*	.1879	.6727*	.5228	.5273		
Mountain Villages	.9758*	.2970	.9273*	.8207*	.8303*	.7212*	—

Note. Correlations are Spearman rank correlation, rho. They are computed across the ten conservation and seriation tasks or across the eight multiple classification matrices (matrix 2 to 9).

(*) P less than 0.05

This pattern of results is rather unusual, and it leads to the inevitable question: Why?. Clearly, this low level of correlation across the migrant versus nonmigrant Turkish samples is due to the reversal of task difficulty noted previously (i.e., that involving Matrices 4 and 7). One must wonder whether there was something in the Anatolian children's environment that made Matrix 4 particularly easy or Matrix 7 particularly difficult. (The converse question might be asked for the migrant and German samples.)

For the conservation and seriation tasks we find a generally lower level of agreement between the orderings of task difficulty. However, in this instance there seems to be a reasonable agreement between the orderings produced by all of the Turkish groups, both migrant and nonmigrant. These correlations between the orderings of task difficulty between Turkish samples range from 0.53 to 0.92. The lowest correlations in this set are found for the children from the transitional village (correlations of 0.53 to 0.67). The correlations between the task difficulty ordering produced by the German children and those produced by each of the non-migrant Turkish samples, however, is rather low (0.19 to 0.44). The correlations for the German sample are higher with the Turkish children who migrated to Germany (0.38 to 0.44) than with the non-Migrant Turkish children (0.19 and 0.30). The latter occurrence is suggestive of an environmental impact of residence in the same culture on the difficulty of solving conservation tasks. We must note, however, that correlations between the German and Turkish samples resident in Germany average only 0.41, while those between the two

nonmigrant Turkish samples are 0.72. And, the correlations across samples who share the same culture of origin and mother tongue but vary in their migrant status (Turkish migrants vs. Turkish nonmigrants) are also rather high:

	Seg. 0-2	Seg. 4+	Integ.
Mountain Vill.	0.93	0.82	0.83
Transit. Vill.	0.67	0.52	0.52

These results might be interpreted as suggesting that there is an underlying consistency of development shared by all of the Turkish samples.

Before taking such an interpretation too seriously, it is important to recognize the problems inherent in our scalogram results. The coefficients of reproducibility for our results range from 0.77 to 0.89, and they indicate that the orderings obtained from the scalogram analyses involve a considerable amount of "scale error." A common minimum value for acceptable scale reproducibility is +0.90 (Torgerson, 1958).

A consideration of the nature of the Piagetian tasks used in this analysis provides some basis for interpreting our failure to obtain adequate Guttman scalings of the tasks. Scalogram analysis assumes that each of our problems taps the same unique trait that is required to solve the problem. This assumption is invalid, as the coefficients of reproducibility indicate. Each of the Piagetian tasks differs not only in the complexity of the logical operations required to solve it, but also in its cultural familiarity, openness to perceptual distortion, relative demands made on memory, and so forth. Thus it is reasonable to expect

that an adequate representation of developmental difficulty of these tasks would require a multidimensional approach.

7.4.2 Nonmetric Multidimensional Scaling. Multidimensional scaling procedures take a slightly more complex approach to these data. This analysis assumes that the ordering of "task difficulty" may be due to more than one factor, that is, it may be multidimensional. The nonmetric multidimensional scaling solutions obtained with the pilot study data were found to be interpretable as:

1. Operational difficulty of the task. That is the inherent cognitive complexity of the operations which must be performed.
2. Situational Complexity. Factors that are extraneous to cognitive function but which otherwise disrupt performance. For example, it is possible that although the use of "distractor" in the one conservation of liquid task does not alter the cognitive complexity of the task, it does cause some children to become confused and give incorrect answers for reasons that are irrelevant to their operational abilities.

Versey (1974) has shown that nonmetric multidimensional scaling analysis can be quite useful in the analysis the results of the Piagetian tasks at the concrete operational stage (see Versey, 1974, Section 8.30). As he describes the procedure, nonmetric multidimensional scaling is:

an attempt to represent certain types of data as relations on points in a multidimensional space. The dimensions of

the space are assumed to represent properties or attributes along which the data events are compared. It is postulated that the distance between any two points in the space is a function of the degree of similarity between the data events. This means that if the two data events are identical then distances between the corresponding points in space is zero, and as the degree of similarity decreases so the distance between the points increases. The method . . . is nonmetric, that is, the input data are in terms of the ordered relations between the data. (Versey, 1974, p. 172)

To assess whether two or more dimensions can account for the pattern of children's performance, we must begin by measuring how similar one task is to another. We are interested in performance, and for our purposes, we might say that two tasks are of equivalent difficulty if (1) every child who passes A passes B, and conversely, (2) every child who fails A, also fails B. While this is a good definition of perfect equivalence, we need definitions for imperfect levels of equivalence.

In conducting our nonmetric multidimensional scaling analysis we began by computing a well known measure of association, Kendall's rank order correlation tau for this purpose. This measure has a value of zero when performance on task A and task B are statistically unrelated. It assumes intermediate values (between 0 and 1) as the extent of association between performance on A and B approaches the perfection noted above. Using Kendall's tau as a measure of the similarity between each pair of tasks, we then submitted the matrix of similarities to a multidimensional scaling algorithm to determine if there was a suitable structure which could be used to make sense of the many observations of task

similarity we had constructed.³

For the two dimensional solutions, the indicator of "goodness of fit" or stress was 0.12 when data from all samples in the main study were used. This result indicates that there was sufficient structure in the data (i.e., the intertask similarities) to reject the hypothesis that the distances were generated at random -- rather than reflecting some underlying orderliness. When subsequent analyses were tried allowing for 3-, 4-, and 5-dimensional values, the stress, of course, declined, but the declines were not nearly as marked as those that occurred between solutions in 1-dimension (rather similar to the unidimensional Guttman scaling solutions) and those in two dimensions. The stress values obtained from these analyses were as follows:

<u>Solution</u>	<u>Stress</u>
1-dimension	0.27
2-dimensions	0.12
3-dimensions	0.08
4-dimensions	0.05
5-dimensions	0.03

³ Kendall's tau was computed using the Statistical Package for the Social Sciences (SPSS) nonparametric correlation procedure. In conducting this analysis the children's performance was scaled 0 for non-operational, 1 for intermediate, and 2 for operational. (Intermediate children were those who gave a correct answer and explanation but who wavered when asked the follow-up question designed to test stability, e.g., would any other picture fit as well into the matrix.)

The resulting matrix consisting of almost 200 measures of similarity between every pair of tasks was then analysed using Torgerson's nonmetric multidimensional scaling procedure as implemented in the computer program KYST by J. Kruskal.

The largest decrement in the goodness-of-fit measures thus occurred in going from a 1-dimensional to a 2-dimensional representation of task difficulty. For the 2-dimensional solution the goodness of fit statistic (stress) declined from 0.27 to 0.12; much smaller improvements in fit were obtained by adding further dimensional complexity. This fact plus the intuitive simplicity of the 2-dimensional solution led us to pursue further subsample analyses using 2-dimensional scalings. (Computational costs and the theoretical and practical complexity of dealing with 5 different solutions for each of the 6 subsamples made it impractical to explore the dimensionality of results separately for each of the six subsamples.)

Figure 7-5 displays the results of the two dimensional multidimensional scaling of results for each task. The input measures of task similarity were, as mentioned previously, the rank order correlations between performance on each pair of tasks. Thus in the results of the nonmetric multidimensional scaling, pairs of tasks that are positioned close to one another will be more highly correlated than those that are separated by large distances. Nonmetric multidimensional scaling solutions are equivalent under any transformation that preserves the relative interpoint distances. That is to say, the array of points shown in Figure 7-5 may be rotated, made into a mirror image inversion, expanded or contracted, without altering the result.

In plotting Figure 7-5, the array of output data produced by the multidimensional scaling program was examined visually and then rotated to produce an intuitively meaningful orientation of points. In particular, the points on both dimensions were

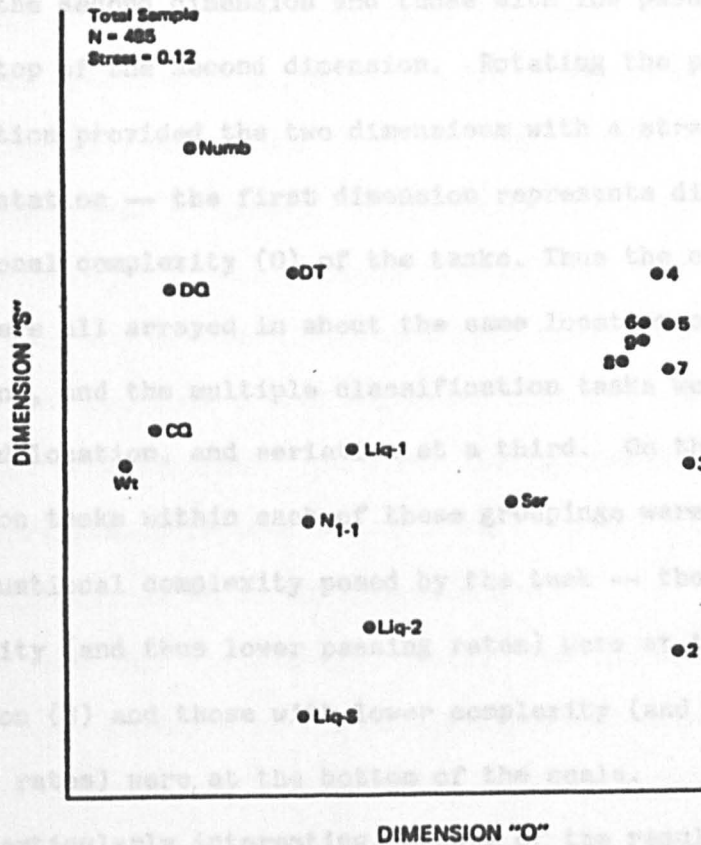


Figure 7-5 Two-Dimensional Solution from Non-Metric Multidimensional Scaling Analysis Using All Children in Main Study.

Points 2 through 9 in the figure represent the multiple classification matrices. The other points represent the various conservation and seriation tasks: Seriation (Ser), Conservation of Discontinuous Quantity (DQ), Liquid 1 (Liq-1), Liquid 2 (Liq-2), Sum and Division of Liquid (Liq-S), Continuous Quantity (CQ), Weight (Wt), Distance and Time (DT), Number: Tower and Cross (Numb), Number: one-to-one correspondence (N:1-1)

arrayed so that the separation of tasks into conservation and classification sets evident in the solution corresponded to one dimension and so that the second dimension was oriented so that tasks with high passing rates (e.g., tasks Matrix 2 and Conservation of Liquid after Sum and Division) were at the low end of the second dimension and those with low passing rates were at the top of the second dimension. Rotating the points to this orientation provided the two dimensions with a straightforward interpretation -- the first dimension represents differences in operational complexity (O) of the tasks. Thus the conservation tasks were all arrayed in about the same location on this dimension, and the multiple classification tasks were arrayed at a second location, and seriation at a third. On the second dimension tasks within each of these groupings were arrayed as to the situational complexity posed by the task -- those with higher complexity (and thus lower passing rates) were at the top of this dimension (S) and those with lower complexity (and thus higher passing rates) were at the bottom of the scale.

A particularly interesting feature of the results shown in Figure 7-5 are the fact that the conservation and multiple classification tasks do form two isolated groupings along the one (operational complexity) dimension. In a report of the pilot study results (See Sevinc and Turner, 1976) a similar isolation had been found for the results from a small sample of English working class school children and from a sample of bilingual Greek-English schoolchildren of similar socioeconomic status. However, in the pilot study data the two-dimensional solution for a sample of Turkish-English bilinguals did not show this pattern,

but rather the conservation and multiple classification tasks were overlapped in such a way that no rotation or inversion of the solution could obtain a separation of the two sets of tasks on either of the two dimensions. In the discussion of this finding it was argued that this result was likely to reflect the fact that the linguistic forms used for conservation in English and Greek (vectors: e.g., more, bigger in English) are morphologically marked and quite distinct (grammatically) from the scalars used in classification tasks (few, small). While in Turkish there is a less rigorous distinction. In particular, the scalar form may be used both for simple description and for comparison, and thus it was suggested that the overlap in the structure of development found for the Turkish-English bilinguals was theoretically important -- although complex effects arising from bilingualism could not be ruled out.

The fact that the overall results from the main study show a clear differentiation of the conservation and classification tasks is contrary to the suggestion inferred from the pilot study data. Of course, this is not exactly a disconfirmation since the main study samples were not exclusively Turkish speaking: they included both a sample of monolingual German speakers as well as various samples of German-Turkish bilinguals. Nonetheless, the overall results are of considerable interest. To further explore this issue the multidimensional scaling was repeated for each subsample, i.e., the Turkish monolingual mountain village children; the Turkish monolingual transitional village children, the segregated migrant children who had resided in Germany 0-2 and 4+ years and who were thus somewhat bilingual, the fully

bilingual integrated Turkish migrants, and the monolingual German children.

The results of these scalings are shown in the Figure 7-6. As before the results were rotated by eye; the numerical values output by the scaling program are shown in the Appendix tables. The results for the individual analyses are considerably more variable. On the individual plots in Figure 7-6 we have attempted to draw a single line in each plot to separate the conservation tasks from the classification and seriation tasks. It will be seen that for some samples this line is straight -- suggesting separation along a single dimension of the two types of tasks. In particular, for the mountain village sample, the short-term segregated migrants, and the monolingual german children, complete separation is achieved -- which is to say that the multidimensional scaling solution does allow for complete isolation on one dimension of the classification and conservation tasks. For the more bilingual groups, (integrated migrants and segregated 4+ years), a similar separation is not possible; the failure to find this separation is most severe for the most bilingual and bicultural group (integrated migrants) and it mainly arises in both instances from multiple classification matrix 4 which is grouped with the conservation rather than the classification tasks.

For the rather small sample ($n = 28$) of children from the transitional village, we find an even more striking pattern of non-separation, however there is good reason to believe that this result may be an artifact arising from the small number of children that were tested.

Leaving aside the transitional village result, it would appear as if separation varies with bilingualism and biculturation. The samples that are completely monolingual and mono-cultural (native German and native Turkish mountain village children) show complete separation of the two types of performance. Similarly, the most bilingual and bicultural sample (integrated migrants) shows the most severe instance of non-separation. The two intermediate groups show intermediate results, i.e., short term migrants show separation of classification and conservation development, while longer-term migrants show a modest level of nonseparation. Thus, if we allow that the very small sample size in the case of the transitional village sample makes its results unreliable, we have a rather consistent pattern from the multiple classification results suggesting that some overlap of the two categories of development is associated with increasing bilingualism and biculturation (at least in the present case).

This, of course raises some questions about the parallel analyses that were performed on the pilot study results. There the fluently bilingual Turkish-English sample showed very considerable overlap and the monolingual English group showed complete separation -- which is consistent with the foregoing results. However, the fluent Greek-English children also showed complete separation.

While we clearly do not have sufficient number of different language pairings to permit a confident generalization, the complete array of results indicate that this result may be specific to native Turkish speaking children and that the overlap

is associated with the fact of increasing bilingualism and biculturation rather than being associated with mastery of the Turkish language. While one clearly must be very cautious in interpreting these results, we do have three relatively bilingual and bicultural samples (Turkish English in pilot study, integrated German-Turkish speakers and long-term segregated migrants in main study) who show a pattern of overlap. Furthermore we have four relatively more monolingual and monocultural groups (German sample, Mountain village sample and short-term segregated Turkish migrants in main study and English children in pilot study) who show complete separation when performance is subjected to multidimensional scaling.

Some further evidence on the similarity of the results obtained for each of the subsamples can be obtained by a slightly more systematic examination of the scaling results. Table 7-15 presents the (Pearson product moment) correlations between the scalings of tasks on the operational and situational complexity dimensions within each subsample. These correlations indicate the degree to which the tasks were similarly arrayed in each subsample. For example, the correlation of 0.8851 between the the German and Mountain Village samples on the operational complexity dimension indicates that the 18 conservation and classification tasks were given a quite similar ordering. This result could be interpreted as meaning that the sequencing of operational development was quite similar in the German and Mountain Village samples. (It should be realized that this does not mean that the actual ordering of development for these groups would be highly similar since the task similarities are posited

Table 7-15a Pearson product moment correlations between scalings of operational complexity dimension derived from nonmetric multidimensional scaling of results for entire sample and for each subsample

	All	Mount.	Trans.	Seg.0-2	Seg.4+	Integ.	German
All	1.0000						
Mountain Village	.9639	1.0000					
Transitional Village	.6621	.5521	1.0000				
Segregated, 0-2 Years	.7560	.7240	.5921	1.0000			
Segregated, 4+ Years	.7785	.7110	.8299	.7274	1.0000		
Integrated	.6907	.5913	.5888	.1660	.4546	1.0000	
German	.8747	.8858	.5189	.7134	.6283	.5420	1.0000

Table 7-15b Pearson product moment correlations between scalings of situational complexity dimension derived from nonmetric multidimensional scaling of results for entire sample and for each subsample

	All	Mount.	Trans.	Seg.0-2	Seg.4+	Integ.	German
All	1.0000						
Mountain Village	.9061	1.0000					
Transitional Village	.0506	.1353	1.0000				
Segregated 0-2 Yr.	.4483	.2091	.0103	1.0000			
Segregated 4+ Yr.	.3338	.3780	.1645	.0910	1.0000		
Integrated	.0002	.0073	.3553	.2416	.0358	1.0000	
German	.7281	.6584	.1386	.1778	.4431	.2422	1.0000

Notes (to Tables 7-15a and b): Correlations are for two-dimensional scaling solutions. Values shown are absolute values of correlations computed from scale points shown in Appendix tables. (Absolute values are appropriate since solutions are equivalent after rotation or when mirror images are used; thus an ordering of A, B, C, D along one dimension is equivalent to D, C, B, A. There is thus no simple basis for inferring negative association from the scaling results.)

Correlations are Pearson product moment correlations. A complete set of both product moment and rank order correlations (including correlations across the situational and operational complexity dimensions) are presented in the Appendix.

to arise from two separate dimensions.) In contrast the correlation of 0.0073 between the situational complexity orderings obtained for the Mountain village and Integrated samples indicate that the multidimensional scalings of situational complexity for these groups were not at all similar (i.e., there was almost random association between the orderings of situational complexity found for the Mountain Village and Integrated samples).

From the top panel of Table 7-15 it can be seen that the operational complexity dimension scores obtained for the Mountain village sample showed most correlation with those obtained from the monolingual and monocultural German group. This is also true in reverse: the scaling of the German results shows most correlation on the operational correlation dimension with the Turkish mountain village sample. For the other groups, there are decreasing levels of correlation -- with the segregated migrants showing more modest correlations (0.76 and 0.78) and the integrated migrants and the transitional village showing the lowest levels of correlation (0.69 and 0.66). Similarly for the German sample, the level of correlation with the segregated migrants is more modest than that with the mountain village sample (0.71 and 0.62) and somewhat lower for the integrated migrants (0.5420) and for the transitional village (0.5189). To provide a visual portrait of these results, Figure 7-6 plots the levels of correlation between the operational complexity scores obtained by the mountain village group and all of the other groups. It will be seen, as noted above, that the correlations are strongest with the Germans and decline across the various

to arise from two separate dimensions.) In contrast the correlation of 0.0073 between the situational complexity orderings obtained for the Mountain village and Integrated samples indicate that the multidimensional scalings of situational complexity for these groups were not at all similar (i.e., there was almost random association between the orderings of situational complexity found for the Mountain Village and Integrated samples).

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In considering this table it is useful to focus on the operational complexity scores obtained by the mountain village group versus those obtained by other groups. It will be seen, as noted above, that the correlations are strongest with the Germans and decline across the various levels of acculturation in the

immigrant samples.

Among the migrant groups, taken separately, we find an extremely low correlation between the operational complexity scores for the short-term segregated migrants and the integrated migrants (0.1660), and rather higher correlations between the long-term segregated and the integrated migrants (0.4546) and also between long-term migrants and the short-term migrants (0.7274).

The situational complexity measures show considerable variation. Only two of the eighteen correlations are large enough to be significant (i.e., p less than 0.05). The situational complexity dimension is not, however, theoretically central (assuming that it has been correctly labelled) since we assume it reflects factors that are not cognitively central but rather extraneous, e.g., the demands the various tasks make on memory, confusing perceptions, the familiarity of the materials, attention, etc.

It is not possible to prove that the labelling of the dimensions is correct. Indeed, one may argue that a two-dimensional scaling is not optimal and thus this situational dimension may represent a collapsing of two or more other dimensions of complexity into a single one.

However, if we accept these solutions, it does appear that there is some regularity to the operational complexity results and the separation of the conservation and classification tasks. Most importantly, these results indicate that the operational complexity dimensions are most similar for those groups that are most bilingual and bicultural. (Based on the findings of our

regression analysis, we would suggest that this may arise from the strong effect that bilingualism/biculturation has on the development of multiple classification skills. As shown previously in Figure 7-3, the order of attainment of conservation and classification skills is partially reversed for bilingual/bicultural subjects.)

7.5 SUMMARY

This chapter has presented our findings in regard to two key questions:

- Is the cognitive performance of children at the concrete operational stage affected by the experience of bilingualism and biculturation?
- And, is the structure of cognitive development constant across groups that vary in their degrees of biculturation and bilingualism?

To the first question, the answer appears to be pretty clear. We found large and statistically significant differences in performance for the groups we tested. These differences were largest on the classification tasks.

On the issue of structure, the findings are less clear. The multidimensional scaling results suggest that there are some variations in the structure of development. However, the results are somewhat ambiguous, and they do not fit well with the hypotheses we developed in analyzing the results of our pilot study.

The clearest and most persuasive evidence of an effect on the structure of development does not arise, however, from the scalogram or multidimensional scaling analyses. Rather the simple counting up of "inconsistent" performers, reveals a striking reversal of the sequence of development (inconsistency is defined as operational performance on the multiple classification tasks but not on the conservation tasks). Our analysis (see Figure 7-3) demonstrates clearly that not only in our main study but also in the pilot study and in an independent study by Heron, there was a reversal of the order of development of multiple classification and conservation skills.

In particular, we found that the more bilingual and bicultural the child, the more likely he was to develop classification skills prior to his developing conservation skills. This result, together with the findings of our regression and covariance analysis, support the general notion that bilingualism and/or biculturation accelerates the development of children's ability to extract and apply classification rules.

These results will be discussed further in Chapter 9 where we present our general conclusions. But first we will turn to the next chapter (Chapter 8) in which we present the second part of our analysis. This part of the analysis focused on the relationship between linguistic development and cognitive development.

Chapter 8

RESULTS II LANGUAGE AND COGNITIVE DEVELOPMENT

The theoretical relationship between language and cognitive development, as well as the more general question of the relation of language to thought, have been topics of considerable philosophical and psychological debate. This debate has, not surprisingly, given rise to a considerable number of empirical studies, as noted in previous chapters.

The present chapter treats a somewhat narrower question:

- What, if anything, is the relationship between linguistic competence and performance on the Piagetian concrete operational tasks.

Given the design of the present study, there are several subsidiary questions which inevitably arise, for example,

- Is there a unitary relationship between language and cognitive development that is true for all languages or does the nature of the relationship depend upon the particular language that is learned?
- Does learning more than one language affect this relationship?

The present study does allow us the opportunity to study this more restricted set of questions -- which hopefully may provide insight into the broader issue of the relation of language to thought. In particular, since several measures of linguistic performance were obtained during the course of our testing, it is possible to provide some empirical evidence on these and other

questions. Each of the measures which will be analysed in this chapter are derived from the "pre-test" measures administered immediately prior to the administration of the conservation and multiple classification tasks. These measures, it will be recalled, were derived from the language tests used by Sinclair de Zwart (1967). Our analyses have focused upon a particular aspect of young children's linguistic competence: the child's mastery of "vectors" (comparative forms such as more or bigger) versus scalars (many or big).

8.1 STRATEGY OF ANALYSIS

There are three fundamental questions to be addressed initially in this analysis:

1. Do the linguistic data show a "developmental" trend, i.e., do older children use the more "sophisticated" forms with greater frequency than younger children?
2. Is there an association between use of the more advanced linguistic forms and development of conservation or multiple classification skills?
3. And finally, if there is an association between linguistic development and development of conservation and/or classification skills, is there any evidence to suggest that language might have an independent effect on cognitive development.

Readers should note that the first two questions have been answered in the affirmative by Sinclair de Zwart (1967) based upon her study of French-speaking children. She, for example,

found that 71 percent of children (n=17) who were classified as conservers (on seriation) used vector forms, while only 9 percent of non-conservers (n=55) used these forms (Sinclair de Zwart, 1967, p. 142). Some evidence for a developmental trend in these measures of language sophistication can be found (or inferred) from the tables she presents. Evidence on the last question, however, is much more difficult to come by, but it is nonetheless crucial to matters of theoretical concern. If cognitive and language skills both "develop" with age, it is not entirely informative to demonstrate that there is an association between language sophistication and cognitive functioning. Some correlation between these two would inevitably result (other things being equal) from the fact that they both increase with age.

This is a problem with many past studies (including Sinclair de Zwart's) of language acquisition and cognitive development: when the analysis is not conducted within age groups, no meaningful conclusion can be drawn about the role language plays in cognitive development.

In the pilot study, an analysis was performed in which age was controlled (using regression techniques) and effects of language (beyond those of maturation) were found, although there were some differences in these effects on conservation and multiple classification performance (between the English monolingual and Greek-English bilinguals versus the Turkish-English). The independent effects of language, however, were found to be considerably smaller than those attributable to maturation per se.

In the present analysis we take a similar approach -- although for clarity of presentation we will restrict this discussion to correlational analyses (including both simple correlations between our cognitive and linguistic measures and also partial correlations controlling for age). These will serve well the purposes of the present discussion. We begin by describing briefly the measures that were constructed as indicators of the children's linguistic competence, we then proceed to examine the correlations between these linguistics measures and age -- to assess the "developmental trend" in our measures. Besides providing evidence of the role of maturation in the development of linguistic competence, it also provides a test of the "validity" for our measures. (This is so because there would be good reason to question the validity and/or reliability of measures of linguistic competence that do not differentiate between 5 year olds and 14 year olds.)

Subsequently we look at the correlations between the measures of linguistic competence and children's performance on the Piagetian conservation and multiple classification tasks. Here we continue to use a summary measure of performance which is the percent of tasks (either conservation or classification) which the child "passed" (i.e., gave a correct answer and an operational explanation). These analyses are performed first for the entire sample -- that is, all of the children who were tested in the main study. Afterwards, the analysis is repeated separately for the (monolingual) Turkish nonimmigrants, for the Turkish migrant children residing in Germany, and finally for the sample of German children.

The intent of using this range of samples was to differentiate the qualitatively different linguistic groups, i.e., the monolingual Turks, the monolingual Germans, and the migrant Turks who differ in the degree of their bilingualism. The last group is more heterogeneous than the others (given their range of bilingualism from somewhat to fluently bilingual), but it seems reasonable for the purpose of the present analyses to combine the various segregated and integrated migrant groups. This will reduce the complexity of the presentation and also provide more reasonable sample sizes for our statistical tests.

Having considered the evidence for a developmental trend in the measures of linguistic competence, and the association between linguistic competence and performance on the conservation and multiple classification tasks, we turn finally to the question of the "independent" effects of linguistic competence on cognitive development. Here, the strategy is to compute the correlation between performance on the linguistic and cognitive measures -- taking account of any correlation that might be expected to arise merely because both outcomes are influenced by maturation (i.e., age). Technically, a relatively simple analysis can be done: it uses the partial correlations (controlling for linear and nonlinear effects of age) as an index of the "independent" association between linguistic competence and (other) cognitive competences.

Having said this, it is vital that one realize the limitations of this approach. Unlike a true experiment, or even as in our quasi-experimental analysis of the between group differences in our cognitive measures, there is no way we might

dare to infer "causality" from the correlations we will analyse in this chapter. We are essentially measuring two aspects of the intellectual capacities of these children at the same point in time. We thus have no way of knowing whether linguistic competence affects operational performance, or vice versa (or any of an almost infinite number of alternatives, e.g., bidirectional causality, or as some would claim, that the two measures are merely features of a more general aspect of "intelligence").

With that important qualification in mind, let us turn to a brief description of the linguistic measures we will be using in our correlational analyses.

8.1.1 Linguistic Measures

Each of the language measures are derived from the "Baseline" pretests described fully in Chapter 6. These tests included:

1. Provoked Use (understanding) of More or Less: this baseline test presented groups consisting of differing numbers of things, e.g., 3 red counters, 6 marbles, 10 sticks, etc. The child was asked to point to groups that had more, less, and the same number of items as a specified reference group. The child's actions were coded to show whether he correctly pointed to an appropriate group in response to these requests. These measures are taken to be indicators of the child's understanding of these words
2. Spontaneous Use of Vectors and Scalars in 2-Sticks
Pretest: this baseline test used two sticks of wood which varied in length and thickness (and also in weight). The

child was asked to tell the tester any differences he found between the two pieces of wood. The child's responses were coded to show whether they used vectors in either describing the physical dimensions or weight of the sticks.

3. Spontaneous Use of Vectors and Scalars in Marble-Doll

Pretest: this test used two dolls between whom the tester distributed 6 marbles (4 big ones and 2 small ones). The child was asked whether the initial distribution was "fair," and the reasons for their judgment of fairness. The child was then asked to make the distribution "fair" and to again state their explanation for its fairness. The child's explanations were scored to show whether or not the children used vectors in their explanations and whether they noted the number of marbles, their size, or both in their explanations of fairness. In addition to scoring explanations for use of vectors, responses were coded to indicate whether the child used "subjective scalars" (e.g., a lot, too many) in their explanations. The latter coding can be thought of a "negative" indicator of competency since it indicates that the child was using a more primitive linguistic form.

Most of the codes used in the following linguistic analyses are simple binary variables, e.g., the child either used (code 1) or did not use (code 0) a vector; correctly (code 1) or incorrectly (code 0) responded when asked to show a group with "more," and so forth. Coding of two variables was slightly more complicated.

We have two measures from the marble-doll pretest which have a natural 3-category format. These questions ask the children to describe differences in the distribution of marbles that vary in size and number. Responses were coded to indicate the number of dimensions the child mentioned in his answer: 0: none; 1: mentioned either number or size; 2: mentioned both number and size dimensions. Since this variable involves a simple counting of the number of dimensions mentioned, it is appropriate to treat it as metric variable. Thus all of the variables are suitable (either binary or metric) for analysis using Pearson's product moment correlation.

8.2 FINDINGS

8.2.1 Simple Correlations

Table 8.1 presents the product moment correlations between each of our linguistic measures and both age and performance on the multiple classification and conservation tasks. This analysis is based on all of the children (nonmigrant, migrant, and German) who were tested in this research. The sole exclusion is the sample of illiterate females, who were not given the pretests. We should note that while our analyses made use of all available data, in a few cases, the notes taken by the tester were insufficient to permit a reasonable coding of the linguistic behavior of the child. Thus the Ns for these analyses often differ slightly from the total sample sizes. Significance tests shown in the tables, however, are based on the correct actual number of cases, and thus are a useful guide to the reliability of the correlation coefficients presented in these tables.

TABLE 8.1
Pearson's
 Product Moment Correlations between Language Usage, Age, and
 Performance on Conservation and Multiple Classification Tasks
 for All Children Tested

Pretest Measurements	SIMPLE CORRELATION WITH		
	Classification	Conservation	Age
LANGUAGE USE			
Vector Used in 2 Stick Pretest	.0964*	.1596**	.1435**
Vector Used for Weight in 2 Stick Pretest	.0897	.2311**	.1232**
Vector Used in Marble-Doll Pretest	.1069*	.2146**	.1118*
Subjective scalar Used in Marble-Doll Pretest	-.0252	-.1717**	-.0051
Understanding of Vector (more) in Pencils Pretest	.1443**	.1655**	.1972**
Understanding of Vector (less) in Pencils Pretest	.0837	.1310**	.1208**
Mentioned Number & Size in Marble-Doll Pretest-1	.0224	.0942*	.0830
Uses Word "Equal" in Marble Doll Pretest	.1511**	.0220	.2638**
Mentioned Number & Size in Marble-Doll Pretest-2	.0964*	.1947**	-.0154
PERFORMANCE			
Correct Redistribution in Marble-Doll Pretest	.2939**	.3244**	.3221**

Note. See text for description of tests. Correlations were computed using all available data. In a few cases, pretest data were missing or inaccurately coded, these cases were excluded from the statistical analysis. The tests of statistical significance for the coefficients use the (diminished) size of the sample in all cases where there is missing data.

Sample included all children tested in main study, i.e., nonmigrant Turkish and German children, and migrant Turkish children. Total N was 458 children.

* $p < .05$

** $p < .01$

8.2.1a Age and Linguistic Competence. Starting first with the "combined" total sample results shown in Table 8.1 we note that six of our nine language measures show the expected developmental correlation. Older children tend to use the more sophisticated linguistic forms (e.g., they were more likely to use vectors). While the developmental coefficients are statistically significant (i.e., reliably different from zero), they are not large. The correlations between these measures and age have a maximum value of .2638 (for use of "equal" in Marble-Doll pretest), and the significant correlations range down to .11. In contrast, we note that the "developmental correlation" between age and actual performance on the Marble-Doll pretest (i.e., whether or not the child produced an equal distribution) was substantially larger in magnitude (+0.3221). Nonetheless we should note that the "developmental correlation" between age and overall performance on the conservation tasks was only +0.2582, suggesting that the correlations for the linguistic measures are not unusually low. However, we do note that three of the linguistic measures show statistically insignificant correlations with age; they were the two measures that counted the number of dimensions of "fairness" recognized in the marble-doll pretest (i.e., number of marbles, size, or both), and the coding of the child's use of subjective scalars.

8.2.1b Linguistic Competence and Cognitive Performance.

Table 8.1 also shows the correlations found in the total sample between our measures of linguistic competence and our summary measures of performance on the Piagetian conservation and multiple classification tasks. It can be seen that for the

combined sample there are a number of significant associations -- particularly between linguistic and cognitive performance. Our three measures of vector use show correlations of .1596, .2146, and .2311 with performance on the conservation tasks. Also, use of subjective scalars shows a significant and appropriately negative correlation with conservation performance (-.1717). Surprisingly, we note that each of the three measures which did not show a significant "developmental" correlation, do have significant correlations with conservation performance (in addition to the subjective scalar code, the number of dimensions of "fairness" mentioned by the respondent in pretests 1 and 2 correlated .0924 and .1947 with conservation).

In contrast to the results for the conservation measures, the multiple classification measures show more modest correlations with our linguistic measures, but nonetheless there are still a relatively large number of significant correlations. Since the multiple classification measures evidence massive inter-group differences which we have attributed in the previous chapter to be due to bilingualism, it is reasonable to question whether the effects shown in Table 8.1 will vary by the degree of bilingualism of the groups tested. To evaluate this possibility Tables 8.2 through 8.4, repeat the analysis of Table 8.1 for each of three groups: nonmigrant Turkish children, migrant Turkish children in Germany, and German children.

Since these subanalyses have considerably smaller sample sizes, we have fewer "significant" correlations to be commented upon. Readers are thus advised that no great importance should be attached to the nonsignificant (i.e., non-starred)

Pearson's
 ^ Product Moment Correlations between Language Usage and
 Performance on Conservation and Multiple Classification Tasks
 for NonMigrant Turkish Children

SIMPLE CORRELATION WITH			
Pretest Measurements	Classification	Conservation	Age
LANGUAGE USE			
Vector Used	.0827	-.0669	.1286
in 2 Stick Pretest			
Vector Used for Weight	.0035	-.0253	.1068
in 2 Stick Pretest			
Vector Used in Marble-Doll	-.0372	-.0149	.0041
Pretest			
Subjective scalar Used	-.0100	-.0438	-.1668
in Marble-Doll Pretest			
Understanding of Vector (more)	.1437*	.0243	.1798
in Pencils Pretest			
Understanding of Vector (less)	.0540	-.0661	.0907
in Pencils Pretest			
Mentioned Number & Size	.0431	.2228**	.1242
in Marble-Doll Pretest-1			
Uses Word "Equal" in Marble	.1172	-.0660	.1447*
Doll Pretest			
Mentioned Number & Size	.1138	.2164**	.0382
in Marble-Doll Pretest-2			
PERFORMANCE			
Correct Redistribution	.2389**	.1896**	.1594*
in Marble-Doll Pretest			

Note. See text for description of tests. Correlations were computed using all available data for all Anatolian Turkish children. (The sample of illiterate women was not included in this analysis.) In a few cases, pretest data were missing or inaccurately coded, these cases were excluded from the statistical analysis. The tests of statistical significance for the coefficients use the (diminished) size of the sample in all cases where there is missing data.

Sample included all nonmigrant Turkish children tested in main study, i.e., mountain and transitional village children. Total N was 190 children.

* $P < .05$

** $P < .01$

Pearson's

TABLE 8.3

Product Moment Correlations between Language Usage and Performance on Conservation and Multiple Classification Tasks for Migrant Turkish Children

SIMPLE CORRELATION WITH			
Pretest Measurements	Classification	Conservation	Age
LANGUAGE USE			
Vector Used	.2114**	.2308**	.2388**
in 2 Stick Pretest			
Vector Used for Weight	.2280**	.2747**	.1858**
in 2 Stick Pretest			
Vector Used in Marble-Doll	.1708*	.1679*	.1666*
Pretest			
Subjective scalar Used	-.0152	.0583	.1115
in Marble-Doll Pretest			
Understanding of Vector (more)	.0683	.0911	.1307
in Pencils Pretest			
Understanding of Vector (less)	.0296	.1822**	.0824
in Pencils Pretest			
Mentioned Number & Size	.0640	.1154	.1087
in Marble-Doll Pretest-1			
Uses Word "Equal" in Marble	.1791*	.2340**	.3268**
Doll Pretest			
Mentioned Number & Size	.0981	.0871	-.0173
in Marble-Doll Pretest-2			
PERFORMANCE			
Correct Redistribution			
in Marble-Doll Pretest	.3717**	.4148**	.4586**

Note. See text for description of tests. Correlations were computed using all available data for migrant Turkish children (i.e., integrated and segregated). In a few cases, pretest data were missing or inaccurately coded, these cases were excluded from the statistical analysis. The tests of statistical significance for the coefficients use the (diminished) size of the sample in all cases where there is missing data.

Sample included all migrant Turkish children tested in main study, i.e., short-term segregated, long-term segregated, and integrated migrants. Total N was 205 children.

* $P < .05$

** $P < .01$

Pearson's
 TABLE 8.4
 Product Moment Correlations between Language Usage and
 Performance on Conservation and Multiple Classification Tasks
 for German Children

Pretest Measurements	SIMPLE CORRELATION WITH		
	Classification	Conservation	Age
LANGUAGE USE			
Vector Used	-.2053	-.1024	-.0253
in 2 Stick Pretest	-.0412	-.0654	.1342
Vector Used for Weight			
in 2 Stick Pretest	.2838*	.2408	.3197*
Vector Used in Marble-Doll			
Pretest	-.0553	.1485	.1641
Subjective scalar Used			
in Marble-Doll Pretest	.1239	.1722	.4045**
Understanding of Vector (more)			
in Pencils Pretest	.0048	.1447	.2798*
Understanding of Vector (less)			
in Pencils Pretest	-.0745	.0885	-.1017
Mentioned Number & Size			
in Marble-Doll Pretest-1	.2247	.1576	.5024**
Uses Word "Equal" in Marble			
Doll Pretest	.0644	.1735	-.1372
Mentioned Number & Size			
in Marble-Doll Pretest-2			
PERFORMANCE			
Correct Redistribution	.3102*	.4373**	.4866**
in Marble-Doll Pretest			

Note. See text for description of tests. Correlations were computed using all available data for the German sample. In a few cases, pretest data were missing or inaccurately coded, these cases were excluded from the statistical analysis. The tests of statistical significance for the coefficients use the (diminished) size of the sample in all cases where there is missing data.

Sample included all German children tested in main study. Total N was 63 children children.

* P < .05

** P < .01

coefficients shown in these tables. These tables do, however, serve to disprove the notion that linguistic performance (at least on these measures) is more closely tied to performance on the conservation tasks than on the multiple classification performance. We note for example that for the migrant children (Table 8.3), use of vectors or in connection with the weight question both have correlations greater than +0.20 with multiple classification performance. Table 8.2 (non-migrant Turks) and Table 8.4 (Germans) present a somewhat unusual appearance: the correlations between linguistic performance and conservation and multiple classification are often negative -- although they are not statistically significant. There are a few significant correlations between language measures and cognitive development (3 for the Turkish sample and 1 for the Germans), and these correlations are positive. (We should point out, however that our one performance measure from the baseline tests (fair distribution of marbles) does show significant positive correlations with performance on the classification and conservation tasks in both subsamples.

In passing, it should also be noted that the "developmental correlations" in the subanalyses (Tables 8.2 to 8.4) are often considerably larger than for the combined sample. We note in particular a correlation of +.5024 between age and use or "equal," and a correlation of +.4045 for use of understanding of the vector more in the German sample (see Table 8.4). Similarly, the "developmental correlations" for the migrant samples are also elevated above the levels found when the samples are combined (compare final column of Table 8.3 to Table 8.1).

TABLE 8.5
Partial Correlations (Controlling Age and Age Squared)
between Language Usage and Performance on Conservation
and Multiple Classification Tasks
For All Children Tested in Study

Pretest Measurements	PARTIAL CORRELATION WITH	
	Classification	Conservation
LANGUAGE USE		
Vector Used in 2 Stick Pretest	.0282	.1358**
Vector Used for Weight in 2 Stick Pretest	.0436	.2369**
Vector Used in Marble-Doll Pretest	.0628	.2137**
Subjective scalar Used in Marble-Doll Pretest	-.0121	-.2072**
Understanding of Vector (more) in Pencils Pretest	.0830	.1351**
Understanding of Vector (less) in Pencils Pretest	.0304	.1064
Mentioned Number & Size in Marble-Doll Pretest-1	-.0287	.0692
Uses Word "Equal" in Marble Doll Pretest	.0145	-.0560
Mentioned Number & Size in Marble-Doll Pretest-2	.1215*	.2008**
PERFORMANCE		
Correct Redistribution in Marble-Doll Pretest	.1601**	.2777**

Note. See text for description of tests. Correlations were computed using all available data for all children tested in the study. (The sample of illiterate women was not included in this analysis.) In a few cases, pretest data were missing or inaccurately coded, these cases were excluded from the statistical analysis. The tests of statistical significance for the coefficients use the (diminished) size of the sample in all cases where there is missing data.

Sample included all children tested in main study, i.e., nonmigrant Turkish and German children, and migrant Turkish children. Total N was 458 children.

* $P < .05$

** $P < .01$

8.2.2 Partial Correlations

In each of Tables 8.1 to 8.4 there were both some significant correlations between age and linguistic competence and also between cognitive development and linguistic competence. We also know from the analyses presented in the previous chapters and the pilot study that there is a significant and substantial correlation between age and performance on our Piagetian measures of cognitive development. For this reason, one must ask about the independent association between linguistic competence and cognitive performance.

Tables 8.5 to 8.8 attempt to respond to this question. In particular, these tables present partial correlation coefficients between our linguistic measures and performance on the conservation and multiple classification tasks controlling for both the linear and non-linear effects of age. (The control variables were age and age squared). The latter variable (age squared) was intended to allow for the fact that the course of development is not entirely captured by a straight line.

It will be seen from Table 8.5 that the partial correlations for the whole sample are generally significant between the conservation measures and the linguistic measures and generally insignificant for the multiple classification measures. Only one of the nine correlations between linguistic measures and multiple classification performance are significant, while for conservation performance the corresponding result is six of nine correlations are significant.

When the analysis is broken down for the nonmigrant vs.

TABLE 8.6
Partial Correlations (Controlling Age and Age Squared)
between Language Usage and Performance on Conservation
and Multiple Classification Tasks
For NonMigrant Children

Pretest Measurements	PARTIAL CORRELATION WITH	
	Classification	Conservation
LANGUAGE USE		
Vector Used in 2 Stick Pretest	.0054	-.1095
Vector Used for Weight in 2 Stick Pretest	-.0620	-.0399
Vector Used in Marble-Doll Pretest	-.0096	-.0058
Subjective scalar Used in Marble-Doll Pretest	.0807	-.0417
Understanding of Vector (more) in Pencils Pretest	.0545	-.0144
Understanding of Vector (less) in Pencils Pretest	-.0055	-.0964
Mentioned Number & Size in Marble-Doll Pretest-1	.0211	.2408**
Uses Word "Equal" in Marble Doll Pretest	.0568	-.0791
Mentioned Number & Size in Marble-Doll Pretest-2	.1184	.1943**
PERFORMANCE		
Correct Redistribution in Marble-Doll Pretest	.1965**	.1752*

Note. See text for description of tests. Correlations were computed using all available data for all Anatolian Turkish children tested in the study. (The sample of illiterate women was not included in this analysis.) In a few cases, pretest data were missing or inaccurately coded, these cases were excluded from the statistical analysis. The tests of statistical significance for the coefficients use the (diminished) size of the sample in all cases where there is missing data.

Sample included all nonmigrant Turkish children tested in main study, i.e., mountain and transitional village children. Total N was 190 children.

* $P < .05$

** $P < .01$

TABLE 8.7
Partial Correlations (Controlling Age and Age Squared)
between Language Usage and Performance on Conservation
and Multiple Classification Tasks
For Migrant Turkish Children

Pretest Measurements	PARTIAL CORRELATION WITH	
	Classification	Conservation
LANGUAGE USE		
Vector Used	.1643	.1855*
in 2 Stick Pretest		
Vector Used for Weight	.2193**	.2586**
in 2 Stick Pretest		
Vector Used in Marble-Doll	.1257	.1235
Pretest		
Subjective scalar Used	-.1087	.0067
in Marble-Doll Pretest		
Understanding of Vector (more)	.0869	.0638
in Pencils Pretest		
Understanding of Vector (less)	.0052	.1627
in Pencils Pretest		
Mentioned Number & Size	-.0771	.0066
in Marble-Doll Pretest-1		
Uses Word "Equal" in Marble	-.0644	.1250
Doll Pretest		
Mentioned Number & Size	.1385	.0627
in Marble-Doll Pretest-2		
PERFORMANCE		
Correct Redistribution		
in Marble-Doll Pretest	.1636	.3540**

Note. See text for description of tests. Correlations were computed using all available data for migrant children tested in the study (i.e., segregated and integrated migrants). In a few cases, pretest data were missing or inaccurately coded, these cases were excluded from the statistical analysis. The tests of statistical significance for the coefficients use the (diminished) size of the sample in all cases where there is missing data.

Sample included all migrant Turkish children tested in main study, i.e., short-term segregated, long-term segregated, and integrated migrants. Total N was 205 children.

* $P < .05$

** $P < .01$

TABLE 8.8
Partial Correlations (Controlling Age and Age Squared)
between Language Usage and Performance on Conservation
and Multiple Classification Tasks
For German Children

Pretest Measurements	PARTIAL CORRELATION WITH	
	Classification	Conservation
LANGUAGE USE		
Vector Used in 2 Stick Pretest	-.2054	-.0999
Vector Used for Weight in 2 Stick Pretest	-.0486	-.1600
Vector Used in Marble-Doll Pretest	.1569	.1393
Subjective scalar Used in Marble-Doll Pretest	-.0564	.0826
Understanding of Vector (more) in Pencils Pretest	-.0146	.0436
Understanding of Vector (less) in Pencils Pretest	-.0976	.0719
Mentioned Number & Size in Marble-Doll Pretest-1	-.0082	.1427
Uses Word "Equal" in Marble Doll Pretest	.0834	-.0368
Mentioned Number & Size in Marble-Doll Pretest-2	.1315	.2202
PERFORMANCE		
Correct Redistribution in Marble-Doll Pretest	.1814	.2945*

Note. See text for description of tests. Correlations were computed using all available data for the German sample. In a few cases, pretest data were missing or inaccurately coded, these cases were excluded from the statistical analysis. The tests of statistical significance for the coefficients use the (diminished) size of the sample in all cases where there is missing data.

Sample included all German children tested in main study. Total N was 63 children.

* $P < .05$

** $P < .01$

migrant vs. German samples we find a great decline in the number of significant correlations. In particular, the significant correlations between linguistic and cognitive measures are as follows:

	Multiple Classification	Conservation
NonMigrant	0 of 9	2 of 9
Migrant	1 of 9	2 of 9
German	0 of 9	0 of 9

While the magnitude of the many of the correlations is not insubstantial, there is little here to comment upon. It appears as if the association we have observed between the linguistic performance measures and the cognitive performance measures could in almost all instances be adequately "explained" as a simple joint function of age: which is to say that both cognitive and linguistic development proceed in a sufficiently parallel form that it would be difficult to sustain the argument that language had a large independent effect on cognitive development. Rather it might be more plausible to argue that as children got older they both used more of the advanced linguistic forms and also were able to solve more of the conservation and multiple classification problems (and hence the correlation between language competence and cognitive performance).

Chapter 9

ASSESSMENT OF RESULTS AND SUGGESTIONS FOR FUTURE RESEARCH

In this chapter we present a summary assessment of the evidence produced by this research and we then present some ideas about further research that might be warranted. The assessment of our research findings is presented in terms of the various hypotheses that motivated the design of the main study (see Section 6.1 for general hypotheses and 6.3.2 for specific hypotheses). These hypotheses can be grouped into three general sets: one about the effects of bilingualism and biculturation on the rate at which children develop cognitive skills, one set about the order in which different skills are developed (i.e., the structure of development); and a third set about the relationship of language mastery (e.g., mastery of vector terms) and cognitive development. We will organize our assessment of the evidence around these three sets of hypotheses.

Readers should be aware that we have chosen to focus attention in this dissertation on selected aspects of the data. Other aspects we have treated only briefly or not at all. Such selectivity in preparing this dissertation was necessary because of limitations of time and resources. In this research, I spent several years collecting a large amount of data on almost 500 children in the main study. The data gathering required numerous trips to rather isolated areas of Turkey, and periods of residence in Germany, not to mention the pilot study of 110 Cypriot and English children in London. In the analyses, however, I have concentrated on the "macro" level results. For example, we have wanted to know whether there was a difference in

performance between the various samples across the entire range of conservation and classification tasks.

The amount of data that resulted from this research, however, is immense. For the 457 children in the main study (exclusive of the uneducated females), I have measurements on several hundred individual variables. While much of this data is summarized in the foregoing chapters, many of the more detailed observations were only used in a minor way in the analyses presented in Chapters 5, 7, and 8. For example, on each Piagetian task our computer file contains a full record of all the explanations offered and choices made by each child at every stage of the testing. While these data were used, of course, in scoring the tasks, we have not done any detailed analyses of the mistakes children make in solving specific Piagetian tasks since these topics are not central to the cross-cultural hypotheses of this research. Similarly a range of social and psychological data were collected ^{Picture} from the children (e.g., Rosenzweig, Frustration Test); these data remain to be analyzed.

Much of this data deals with questions that are quite interesting theoretically. Therefore, I hope to be able to make further analyses of these data in the future.

Let us now review the evidence on the hypotheses that were central to this dissertation.

9.1 HYPOTHESES ABOUT CROSS-SAMPLE DIFFERENCES IN RATE OF PERFORMANCE

Based on the results of previous cross-cultural Piagetian studies, it was expected when this research was originally planned in the early 1970's that there would be an increase in

the rate of concrete operational performance among our migrant samples. At a general level we had initially hypothesized (see Section 6.1) that exposure to industrialized culture would accelerate cognitive performance. This hypothesis was consistent with what had been found by several other researchers working with stationary populations (see Dasen, 1972, 1977; Ghuman, 1978). By using groups who were in the process of migration and adjustment to a second culture we hoped to provide a sounder scientific basis for inferring that there was a relation, and also to test the specific notion that the longer the exposure to an industrialized Western culture and the more intense that exposure (i.e., the greater the integration into host culture), the greater the similarity that should be found between the migrant group and native children from the host (Western) culture.

As a result of initial readings on language and cognitive development (particularly the comments of Piaget and others on the interesting case posed by the linguistic structure of Turkish), the scope of this research was expanded to consider the relationship between linguistic factors and cognitive development (see discussion of aims of the pilot study in Section 5.1.). As noted previously, our initial hypotheses about the role of language were further refined as a result of Beilin's (1976) comments on the publication of the pilot study for this research (Sevino and Turner, 1976). In particular, bilingualism came to figure more centrally in our thinking about the factors that were causing alterations in children's rates of cognitive development. In addition, the difference in the pattern of results (i.e., the

"structure" of development) for conservation and classification became a secondary focus of attention.

We will proceed by assessing the results obtained in the main study for the specific hypotheses that were proposed in Section 6.3.2.

Based on our general hypothesis, we proposed that:

Hypothesis 1: All of the Turkish migrant samples should show more advanced levels of cognitive development than the non-migrant Anatolian samples (since they have greater exposure to industrialized Western culture and to a second language).

This hypothesis is consistently confirmed. In all of our analyses, the performance of the nonmigrant children (particularly those from the mountain villages) lags behind that of the migrant Turkish groups. In our formal test (see Table 7-8 and Figure 7-4), there were significant differences across the samples in the average passing rates (controlling for age and age-squared). The performance of the migrant groups exceeded that of the mountain village children by a large margin on multiple classification and by a smaller margin on conservation, i.e.,

	RELATIVE PERFORMANCE	
	<u>Mult. Class.</u>	<u>Conservation</u>
Integrated	+43.4%	+8.8%
Segregated, 0-2 Yrs.	+27.7%	+2.0%
Segregated, 4+ Yrs.	+21.4%	+4.3%

Our second specific hypothesis concerned the performance of the two groups from Anatolia: the mountain village children and the children from the transitional coastal village. Based on the

fact that the transitional village had greater social organization and more contact with the outside world, it was hypothesized that

Hypothesis 2: Among the non-migrant Anatolian Turkish samples, the transitional village sample should show more advanced levels of cognitive development than the mountain village samples (due to greater exposure to a more complex social order).

The results for this hypothesis are mixed. The children from the transitional village do better than the mountain village children on the multiple classification tasks. As shown in Table 7-8, the children from the transitional village solved an average of 15.1 percent more of the multiple classification problems (controlling for age and age-squared). This result is statistically significant with $t = 2.7067$ (which rejects the null hypothesis of "no difference" with $p < .01$). On the conservation and seriation tasks, however, the transitional village children solved slightly fewer problems (-2.5 percent); this result is, however, not significant ($t = .503$, n.s.). Our second hypothesis is thus only partially confirmed. We might interpret this result as suggesting that the relatively greater differentiation in the transitional village had an effect only on multiple classification tasks because, by definition, these tasks require a higher degree of categorization perceptually and topically.

Our third hypothesis concerned the level of development within the three migrant samples. We hypothesized that:

Hypothesis 3: Among the various groups of Turkish migrants to Germany, the levels of their cognitive development at each age should reflect the degree of their exposure to and integration into German society. Thus the highest level of development would be expected from the integrated long-term migrants, a lesser degree from the long-term segregated migrants, and the lowest level from the short-term segregated migrants.

The results of our formal tests are generally in accord with this hypothesis, but again the results are only clear for the multiple classification results -- and even here one needs to be cautious.

When we consider the variations in group performance (again controlling age and age-squared) we find that on the multiple classification problems there is the anticipated ordering of performance. The results of our analysis and the standard errors for these results are shown below. (As before, the performance of each group is compared to our baseline group -- the mountain village children.)

	<u>Mult. Classif. Relative Performance</u>	<u>Std. Error</u>
Integrated	+43.44%	3.75
Segregated, 4+ Yrs.	+27.69%	4.10
Segregated, 0-2 Yrs.	+21.39%	4.20

It will be seen from this result that the ordering of performance is as hypothesized: the Integrated children do best, the short-term segregated do least well of the migrants, and the long-term segregated migrants are intermediate. We also note that 1.96 times the standard error for any of these results is its 95 percent confidence interval. Thus it can be shown that the performance of the two segregated migrant groups (+27.69 and +21.39 percent) lies outside of the 95-percent confidence interval for the integrated group, which is

$$43.44 \pm (1.96 \times 3.75)$$

that is,

$$+35.90 \leq \text{Integrated} \leq 60.94$$

This indicates that were we to repeat the study a large number of times and compute the same regression equation (controlling age and age-squared), we would expect the advantage of the Integrated children to lie in the range of 35.90 to 60.94 percent. The results for the two segregated groups are well outside of this range. Thus we can be fairly confident that this hypothesis is supported for the comparison of the integrated versus segregated migrants on multiple classification performance.

The comparison of the two segregated groups is also in the predicted direction. However, the difference between these two groups (+27.69 versus +21.39 percent = 6.60 percent) is only borderline given that the standard errors are about 4 percent. Thus for the comparison of the two segregated groups, the results are very suggestive but not conclusively proven.

On the conservation tasks, the results do not support the hypothesis. Specifically, we find very small differences between the groups, and these differences are not large enough to be statistically reliable:

	<u>Conservation Relative Performance</u>	<u>Std. Error</u>
Integrated	+8.79%	3.36
Segregated, 0-2 Yrs.	+4.26%	3.77
Segregated, 4+ Yrs.	+1.95%	3.68

Two further things can be seen from this display of results. First, the differences between the groups are not nearly as large as those found for the multiple classification results. Secondly, the ordering of the groups was not as predicted, that is, we found that the longer-term segregated migrants did worse

on average (controlling age and age-squared) than the shorter-term migrants. This result, however, should not be taken too seriously. It will be noted that the standard errors for the performance estimates averaged about 3.5, and thus the 95-percent confidence intervals would be about 7 percent. Since the spread of results is less than this ($8.79 \text{ minus } 1.95 = 6.84$), the proper conclusion is that the differences are not large enough to support statistically valid conclusions.

Thus, the general conclusion for this hypothesis is that it is generally supported for multiple classification skills but not for conservation.

Our fourth hypothesis was:

Hypothesis 4: If it is only exposure to advanced industrial society that accelerates development (and not biculturalism or bilingualism), we would not expect any group of migrant Turkish children to exceed the performance of native German children (of the same age). If, on the other hand, there were advantages to experiencing two cultures or learning two languages, it is possible that some of the migrant groups might surpass the native Germans in their cognitive development.

The results of the main study indicate that at least one group of Turkish children exceeded the performance of the native Germans. On the multiple classification tasks the performance of the integrated children was +43.44 percent versus +35.68 percent for the Germans. On the conservation tasks the integrated performance was +8.79 percent versus +0.21 percent for the German children. (The standard errors for each of these results were between 3 and 4 percent. And so these differences are significant. As before, the analysis controls for age and age-

squared, and it contrasts the performance of each group to the performance of the mountain village sample.)

These results confirm the hypothesis. For both conservation and multiple classification performance, it appears that biculturation and bilingualism may convey advantages that allow (relatively underprivileged) migrant children to exceed the performance of the native children in their new culture.

Hypothesis 5: Among the various groups, the largest differences in performance should appear for multiple classification performance (since this is the domain most affected by bilingualism).

This hypothesis has already been discussed in our consideration of the other specific hypotheses of the study. Generally the differences in multiple classification performance were found to be considerably larger than those found for conservation performance. This can be seen most simply by looking at Figure 7-4. There it will be seen that the gap between the multiple classification performance of the various groups in our main study are much larger than the gaps between their conservation performance.

9.2 HYPOTHESES ABOUT CROSS-SAMPLE VARIATION IN STRUCTURE OF DEVELOPMENT

Our second set of hypothesis dealt with the "structure" of cognitive development, that is, with the sequence in which different groups of children developed the cognitive skills required to solve the various concrete operational tasks. For this set of hypotheses we have both some clear cut results, and some ambiguous findings.

Our first hypothesis was that there would be a reversal in the order in which classification and conservation skills developed. In particular, given the results of the pilot study and our review of the literature on the effects of bilingualism in early childhood, it was anticipated that children who became bilingual at an early age would experience accelerated development of their classification abilities, and therefore:

Hypothesis 6: There would be a reversal of the pattern of competence on the classification (matrix) tasks between monolingual non-migrant Turks and bilingual Turkish migrants to Germany.

This hypothesis was confirmed (see Figure 7-3). Among the Integrated Migrant children we found that 41 percent of the children who were operational on the multiple classification tasks had not yet become operational on the conservation tasks (i.e., pattern: M+C-), among Segregated Migrants this figure fell to 31 percent, and among the NonMigrants it was only 9 percent. These differences were highly significant ($p < .001$), and they indicate that the more bilingual and bicultural the group, the more likely they are to develop classification skill before they have full mastery of conservation. A similar pattern of results was also found for the bilingual Cypriot children in the pilot study and for an independent sample of migrant children in Australia tested by Alastair Heron. [While the analysis shown in Figure 7-3 provides strong support for the hypothesis that bilingualism alters the sequence of cognitive development, the more detailed results of the multidimensional scaling analysis (see Section 7.4.2) performed on each of the samples produced a

rather complicated picture of these structural differences in development.]

Our experiences with scalogram analysis and nonmetric multidimensional scaling in the pilot study had also led us to hypothesize that

Hypothesis 7: The difficulty of the Piagetian tasks should require at least two dimensions to represent their difficulty, e.g., operational difficulty and situational difficulty of the tasks;

This hypothesis is supported by both the result of the scalogram analysis (a unidimensional procedure) and by the goodness of fit values for the 1-dimensional solution in the nonmetric multidimensional scaling analysis. The relatively low values (less than 0.90) of the coefficient of reproducibility for the scalogram analyses and the relatively high stress (0.27 using entire sample) for the 1-dimensional nonmetric multidimensional scaling are strong evidence that there are at least two dimensions of difficulty represented in the concrete operational tasks.

Our multidimensional scaling analyses were thus based on the 2-dimensional solutions. For the whole sample this solution achieves a tolerable fit to the data (stress = +0.12 for 2-dimensional solution versus +0.27 in 1-dimensional solution).¹

¹ We should note that all nonmetric multidimensional scaling solutions in the main study were computed using the KYST computer program. This is a newer computer procedure than TORSCA; it was developed by Shepard and other researchers at Bell Laboratories. It is important to note that the "stress" values (formula 2) produced by this program are two times the stress (formula 1) values reported by TORSCA. Thus a stress (formula 2) of 0.12 from KYST is equivalent to a stress (formula 1) of 0.06 from TORSCA.

Use of a third dimension does further improve the goodness of fit (stress = 0.08), however the improvement is not dramatic. The 2-dimensional solution may be interpreted as representing two components of task difficulty: (1) the operational complexity of the task, and (2) the situational complexity (i.e., extraneous factors such as demands the tasks makes on memory, the "familiarity" of the materials, etc.)

9.3 HYPOTHESES ABOUT RELATION OF LANGUAGE MASTERY AND COGNITIVE DEVELOPMENT

Our third set of hypotheses dealt with the relationship between language mastery and cognitive development. In particular, we were interested in pursuing a line of research suggested by Sinclair de Zwart. She found an overall association between operational performance on the Piagetian concrete operational tasks and children's mastery of more sophisticated linguistic forms (e.g., vectors). Unfortunately her analysis did not control for age as a "confounding" factor.

Our first hypothesis followed from Sinclair de Zwart's finding of a positive association between linguistic development and cognitive development:

Hypothesis 8: There would be an association between linguistic development (e.g., mastery of vector terms) and cognitive development.

Not surprisingly, this hypothesis was confirmed. Table 8-1 shows that there were significant correlations ($p < .05$) between many of our linguistic measures and performance on the conservation

and classification performance of the children we tested. The largest of these correlations was +.2311 between use of a vector for weight in the 2-stick pretest and performance on the conservation tasks.

Such results, however, may reflect the common effects of maturation on both cognitive and linguistic development. Thus our two further hypotheses were that:

Hypothesis 9: This association between language development and cognitive development would be largely due to age (maturity increasing the sophistication of the child's language and the level of his cognitive development);

Hypothesis 10: When age is controlled, there would be a more modest level of association between linguistic performance and cognitive performance.

These hypotheses were both confirmed. Thus we found that there were significant positive correlations between age and our measures of linguistic development. (The largest of these correlations was +0.2638 between age and use of the word "equal" in the marble-doll pretest.) Furthermore, when partial correlations were computed between our linguistic measures and conservation and multiple classification performance (controlling age) we found that very few of the correlations were statistically significant. This indicates that a common maturational effect accounts for most of the association between the level of children's language mastery and the level of their cognitive development. When age is controlled there remains only a slight correlation.

9.4 SUGGESTIONS FOR FUTURE RESEARCH

The literature on the effects of bilingualism and biculturation reviewed in Chapter 2 began to suggest during the

1970's that there might be positive advantages to bilingualism and biculturation. Past studies, however, have either had quite small sample sizes and/or they have compared stationary populations, e.g., native children to a cross-section of immigrant children. (This is the same design used in our pilot study.)

Because of these limitations of past research, the "cognitive advantages" of bilingualism have not been convincingly demonstrated. The present study, I believe, provides a more adequate and detailed demonstration than has previously existed. In particular, our findings indicate that a quite remarkable acceleration occurs in children's classification abilities as they become more bilingual (and bicultural). The findings for our various samples indicate that among our Turkish subjects the greatest acceleration was found in the Integrated group and a more moderate level of acceleration was evident among the segregated migrants. This result conforms to our expectation that the degree of advantage should be proportionate to the intensity of children's exposure to a second language and culture.

Our findings, moreover, have demonstrated that this cognitive advantage is quite specific; it strongly affects some cognitive abilities (e.g., classification) but only weakly affects others (conservation). To generalize this result, we would argue from the present data that the development of (some) symbolic reasoning abilities are accelerated by the experience of learning a second set of language symbols and transformational rules (i.e., the lexicon and syntax of a second language).

There is, of course, much that remains to be studied. As noted previously, the data collected in the main study is quite rich and there are aspects of these data that deserve further analysis (e.g., understanding the types of mistakes children in each group make in trying to solve the concrete operational problems). In addition to such further work with the present data, it would seem that there are some obvious next steps for research. Among these I would suggest the following:

- An experimental replication of this study using random assignment. Such a study might be made by randomly assigning children in one school to take part (or not to take part) in a long-term language immersion program.

While such an experimental study would be complex to arrange, it could provide a truly definitive determination of the effects of bilingualism, per se (exclusive of any contaminating effects of biculturation and other factors that make migrant populations different from native populations.) Moreover, if one believes that our results demonstrate a cognitive advantage to bilingualism, such an experiment would allow a proper test of whether this effect can be induced by in-school teaching of a second language.

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REFERENCES

- Albert, M. and Obler, L. (1978) The Bilingual Brain: Neuropsychological and Neurolinguistic Aspects of Bilingualism. New York: Academic Press.
- Almy, M. (1970) Logical Thinking in the Second Grade. New York: Teachers College Press.
- Almy, M., Chittenden, E., and Miller, P. (1966) Young Children's Thinking. New York: Teachers College Press.
- Anastasiow, N. and Hanes, M. (1974) Cognitive development and the acquisition of language in three subcultural groups. Developmental Psychology, 10,703-709.
- Anderson, J. (1975) Computer simulation of a language acquisition system: a first report. Information Processing and Cognition. Hillsdale, N.J.: Lawrence Erlbaum and Associates.
- Anglin, J.M. (1975) The Growth of Word Meaning. Cambridge: MIT Press.
- Anglin, M. (1977) Word, Object and Conceptual Development. New York: Norton.
- Anisfeld, E., and Lambert, W. (1964) Evaluational reactions of bilingual and monolingual children to spoken languages. Journal of Abnormal and Social Psychology, 69, 89-97.
- Bain, B.C. and Yu, A. (1978) Toward an theory of integration of Piaget and Vygotsky: A cross cultural replication (France, Germany, Canada) concerning cognitive consequences of bilingualism. In M. Paradis (Ed.) Aspects of Bilingualism. Columbia, South Carolina: Hornbeam Press.
- Balkan, L. (1970) Les Effets du Bilingualisme Francais-Anglais sur les Aptitudes Intellectuelles. Brussels: Aimav.
- Baluch, (1982) Language Switching: A Comparison of Persian and French Bilinguals Unpublished Master's dissertation, University of London, Institute of Education.
- Barbier de Meynard, A.C. (1971). Dictionnaire Turc-Francais, 2 vols., Paris: 1881 (reprinted Amsterdam: Philo Press, 1971).
- Barik, H. and Swain, M. (1976) A longitudinal study of bilingual and cognitive development. International Journal of Psychology, 11(4), 251-263.

- Basso, K. (1972) Ice and travel among the Fort Norman Slave: Folk taxonomies and cultural rules. Language in Society, 1, 31-49.
- Beardsmore, B. (1982) Bilingualism: Basic Principles. London: Multilingual Matters, Ltd.
- Beilin, H. (1975) Studies in the Cognitive Basis of Language Development. New York: Academic Press.
- Beilin, H. A. (1968). Cognitive capacities of young children: a replication. Science, 162, 920-921.
- Beilin, H. A. (1976). Constructing cognitive operations linguistically. In H. Reese (Ed.), Advances in Child Development and Behavior: 1976, Volume 2, New York: Academic Press.
- Beilin, H. and Lust, B. (1975) A study in the development of linguistic connectivities: Cognitive data and summary. Studies in the Cognitive Basis of Language Development. New York: Academic Press.
- Ben Zeev (1972) The Influence of Bilingualism on Cognitive Development and Cognitive Strategy. Unpublished Ph.D. Dissertation, University of Chicago.
- Ben Zeev, S. (1976) Influence of bilingualism on cognitive development and cognitive strategy. In Papers and Reports on Child Language Development, 12, 39-46.
- Ben Zeev, S. (1977) Mechanisms by which childhood Bilingualism affects understanding of language and cognitive development. In Hornby (Ed.), Understanding of Language and Cognitive Structures in Bilingualism: Psychological, Social and Educational Implications. New York: Academic Press.
- Ben Zeev, S. (1984) Bilingualism and cognitive development. in Bilingualism and Language Disability: Assessment and Remediation. Kent.
- Bentahila, A. (1983) Language Attitudes among Arabic-French Bilinguals in Morocco. (Multilingual Matters No. 4) London: Multilingual Matters Ltd.
- Bentler, P. (1971). Monotonicity analysis: an alternative to linear factor and test analysis. In D. Green (Ed.) Measurement and Piaget. New York: McGraw-Hill.
- Berlin, B., Breedlove, D. E. and Raven, P. H. (1968) Covert categories of folk taxonomies. American Psychologist, 70, 290-299.

- Berlin, C., Lowe-Bell, S., Porter, R., Berlin, H. and Thompson, C. (1972) Dichotic signs of the recognition of speech elements in normals, temporal lobectomies, and hemispherectomies. Proceedings of International Conference on Speech Communication and Processing. Boston, Mass.: April 24-26, 1972
- Berlyne, D. (1955) Arousal and satiation of perceptual curiosity in the rat. Journal of Comparative Physiological Psychology, 48, 238-246.
- Berlyne, D. E. (1965) Structure and Direction in Thinking. New York: Wiley.
- Bernstein, B. (1961) Social Class and Linguistic development: a theory of social learning. In Halsey, Floud, and Anderson (ed), Education, Economy and Society. New York: Free Press, 222-314.
- Bernstein, B. (1971) Class, Codes, Control: Vol. 1: Theoretical Studies Toward a Sociology of Language. London: Routledge and Kegan Paul.
- Bernstein, B. (1972) Social Class, Language and Socialization. In P. Giglioli (Ed.), Language and Social Context. London: Penguin Modern Sociology Readings.
- Bernstein, B. (1973) Class, Codes, Control: Vol. 2: Applied Studies Towards a Sociology of Language. London: Routledge and Kegan Paul.
- Berry, J. W. (1966) Temne and Eskimo perceptual skills. International Journal of Psychology, 1, 207.
- Berry, J. W. (1976) Human Ecology and Cognitive Style Beverly Hills, Cal.: Sage/Halsted.
- Berry, J.W. and Dasen, P.R. (1974) Culture and Cognition. London: Methuen.
- Berthoud, I., and Sinclair, H.L. (1978) L'expression d'éventualités et de conditions chez l'enfant. Archives de Psychologie, XLVI(179), 205-233.
- Bever, T., Mehler, J. and Epstein, J. (1968). What children do in spite of what they know. Science, 162, 921-924.
- Blank, M. (1974) Cognitive functions of language in the pre-school years. Developmental Psychology, 10, 229-245.
- Bloom, A.H. (1981) Linguistic Shaping of Thought: a study in the impact of language on thinking in China and the West. Hillsdale, New Jersey: Lawrence Erlbaum Associates.

- Bloomfield, L. (1933) Language. New York: Holt, Rinehart and Winston.
- Borelli, M. (1951) La genese des operations logiques chez les Sourdsmuets. Enfance, 222-228.
- Bottrill, J. (1967) Effects of pre-school experience on the readiness levels of privileged and underprivileged children. Exceptional Children, 1967, 34, 275ff.
- Bovet, M.C. (1974) Cognitive process among illiterate children and adults. Pages 311-314 in J.W. Berry, and P.R. Dasen (Eds.), Culture and Cognition. London: Methuen.
- Bowerman, M. (1980) Language Development. In H. Triandis and A. Heron (Eds.), Handbook of Cross-Cultural Psychology, Volume 4. Boston: Alwyn and Bacon.
- Braine, M. D. S. (1959) The ontogeny of certain logical operations: Piaget's formulations examined by nonverbal methods. Psychological Monographs, 73(5), whole no. 475.
- Braine, M. D. S. (1962) Piaget on reasoning: a methodological critique and alternative proposals. Monographs of the Society for Research in Child Development, 27(2), 41-63.
- Brainerd, C. J. (1973) Judgments and explanations as criteria for the presence of cognitive structures. Psychological Bulletin, 79, 172-179.
- Brainerd, C.J. (1978) Piaget's Theory of Intelligence. Englewood Cliffs, New Jersey: Prentice Hall.
- Brainerd, C.J. (1978) The Stage question of cognitive-developmental theory. Behavioral and Brain Sciences, 2, 173-213.
- Bronfenbrenner, U. (1970) Socialization and social class through time and space. In Bendix, R. and Lipset, M. (Eds.), Class, Status, and Power. New York: Macmillan.
- Brown, G. and Desforges, C. (1979) Piaget's Theory: Psychological Critique..
- Brown, R. and Lenneberg, E. H. (1954) A study in language and cognition. Journal of Abnormal and Social Psychology, 49, 454-62.
- Bruck, M., Lambert, W.E., and Tucker, G.R. (1973) Cognitive and Attitudinal Consequences of Bilingual Schooling: the St. Lambert Project through grade six.. Montreal: McGill University.

- Bruck, M., Lambert, W.E., and Tucker, G.R. (1974) Bilingual schooling through the elementary grades. Language Learning, 24, 183-204.
- Bruner, J. S. (1964) The course of cognitive growth. American Psychologist, 19, 1-15.
- Bruner, J. S. (1971) The perfectability of the intellect. Desai, M. R. (Ed.) Essays on Modernization of Underdeveloped Societies, Vol 1. Bombay.
- Bruner, J. S. (1973) Beyond the Information Given. Anglin, J. M. (Ed.) New York: W. W. Norton and Co.
- Bruner, J. S. (1975) Language as an instrument of thought. In A. Davies (Ed.) Problems of Language and Learning. London: Heinemann.
- Bruner, J. S. (1975) The ontogenesis of speech acts. Journal of Child Language, 2, 1-19.
- Bruner, J. S. (1978) The role of dialogue. In H. Sinclair (Ed.), The Child's Conception of Language.
- Bruner, J. S. and Kenney, H. (1966) On multiple ordering. In J. Bruner, R. Oliver, and P. Greenfield (Eds.), Studies in Cognitive Growth. New York: Wiley.
- Bruner, J. S., Oliver, R. R., Greenfield, P.M. (1966) Studies in Cognitive Growth, New York: Wiley.
- Bryant, P. (1974). Perception and understanding in the young child. London: Methuen.
- Bull, W. (1963). Time, tense and the verb. Berkeley: University of California Press.
- Burling, R. (1978) Language development of a Garo and English speaking child. In E. Hatch (Ed.), Second Language Acquisition. Rowley, Mass.: Newbury House.
- Butler, R. and Harlow, H. (1957) Discrimination learning and learning sets to visual exploration incentives. Journal of Genetic Psychology, 1957, 57, 257ff.
- Carraher, N.T., Carraher, D.W. and Schlieman, A.D. (1985) Mathematics in the streets and schools. British Journal of Developmental Psychology, 3, 21-29.
- Casserly, M.C. and Edwards, H.P. (1973) Detrimental effects of grade one bilingual programs: An exploratory study Paper presented to the annual conference of the Canadian Psychological Association.

- Castles, S. and Kosack, G. (1973) Immigrant Workers and Class Structure in Western Europe. Oxford: Oxford University Press.
- Chettaoui, A. (1977-78) Bilingualism and elementary education in Tunis. Bulletin de Psychologie, 31(10-11), 521-535.
- Chittenden, E. (1964) The Development of Logical Abilities and the Child's Concepts of Substance and Weight. Unpublished Ph.D. dissertation, Teachers College, Columbia University, 1964.
- Clyne, M. (1978) Some (German-English) Language Contact phenomena at the discourse level. In J. Fishman (Ed.), Advances in the Study of Societal Multilingualism. The Hague: Mouton.
- Colby, B. and Cole, M. (1973) Culture, Memory and Narrative. Horton, M.R. and Finnegan, R. (Eds.) Modes of Thought: Essays on Thinking in Western and Nonwestern Societies. London: Faber and Faber.
- Cole, M. and Scribner, S. (1974) Culture and Thought. New York: Wiley.
- Cole, M., Gay, J., Glick, J., Sharp, D.W. (1971) The Cultural Context of Learning and Thinking. New York: Basic Books.
- Cole, M., Gay., and Glick, J. (1968) Some experimental studies of Kpelle quantitative behavior. Psychonomic Monograph Supplements, 2(whole no. 26), 173-90.
- Cole, M., Sharp, D.W., and Lave, C. (1976) The cognitive consequences of education. Urban Review, 9, 218-233.
- Cooper, R. and Zubeck, J. (1958) Effects of enriched and restricted early environments on the learning ability of bright and dull rats, Canadian Journal of Psychology, 12, 159-164.
- Cosgrove, J.M. and Patterson, C.J. (1978) Generalization of training for children's listening skills. Developmental Psychology, 49, 513-516.
- Covington, V. (1967) Stimulus deprivation as a function of social class membership. Child Development, 38, 2, 607ff.
- Covington, V. (1980) Problems of acculturation into the deaf community. Sign Language Studies, 28, 267-285.
- Cronbach, L.J. (1951) Coefficient alpha and the internal structure of tests. Psychometrika, 16, 297-334.

- Cummins, J. (1977) Cognitive factors associated with the attainment of intermediate levels of bilingual skills. Modern Language Journal, 61, 3-12.
- Cummins, J. (1977) Educational Implications of Mother Tongue Maintenance in Minority Language Groups. Paper presented to the 4th LACUS Forum, Montreal, Canada. (Summarized in T. Skutnabb-Kangas (1983) Bilingualism or Not: The Education of Minorities. London: Multicultural Matters, Ltd.)
- Cummins, J. (1978) Bilingualism and the development of metalinguistic awareness. Journal of Cross-Cultural Psychology, 9, 131-149.
- Cummins, J. (1979) Cognitive/academic language proficiency, linguistic interdependence, the optimum age question and some other matters. Working Papers on Bilingualism, 19, 121-129.
- Cummins, J. (1984) Bilingualism and Special Education Issues in Assessment and Pedagogy. London: Multilingual and Multicultural Matters, Ltd.
- Cummins, J. and Gulutsan, M. (1974) Some effects of bilingualism on cognitive functioning. In S. Carey (Ed.), Bilingualism, Biculturation, and Education. Edmonton: University of Alberta Press.
- Cummins, J. and Mulcahy, R. (1978) Orientation to language in Ukrainian-English bilingual children. Child Development, 49(4), 1239-1242.
- Darcy, N. (1946) The effect of bilingualism on the measurement of the intelligence of children. Journal of Educational Psychology, 37, 21-44.
- Darcy, N.T. (1953) A review of the literature on the effects of bilingualism on the measurement of intelligence. Journal of Genetic Psychology, 82, 21-57.
- Darcy, N.T. (1963) Bilingualism and the measurement of intelligence: a review of a decade of research. Journal of Genetic Psychology, 103, 259-282.
- Dasen, P. (1972) Cross-cultural Piagetian research: a summary. Journal of Cross-Cultural Psychology, 3, 23-29.
- Dasen, P. (1975) Concrete Operational development in three cultures. Journal of Cross-Cultural Psychology, 6, 156-172.

- Dasen, P. (1977) Are cognitive processes universal? A contribution to cross-cultural Piagetian psychology. In N. Warren (Ed.), Studies in Cross-Cultural Psychology. Volume 1. London: Academic Press.
- Dasen, P. (Ed.) (1977) Piagetian Psychology: Cross-Cultural Contributions. New York: Gardner Press.
- Dasen, P. and Heron, A. (1980) Cross-cultural tests of Piaget's theory. In H. Triandis and A. Heron (Eds.), Handbook of Cross-Cultural Psychology, Volume 4. Boston: Alwyn and Bacon.
- Dasen, P.R., Nglini, L., and Lavellee, M. (1978) Cross-Cultural Training Studies of Concrete Operations. Paper presented at the 4th International Association for Cross-Cultural Psychology, Munich (July 28-August 5).
- Davis, E. (1937) The development of linguistics skills in twins, (Institute of Child Welfare Monograph), Minneapolis, University of Minnesota Press, 1937.
- Davis, K. (1947) Final note on a case of extreme deprivation. American Journal of Sociology, 57, 432-457.
- Dawson, J.L.M. (1967) Cultural and Physiological influences upon spatial-perceptual processes in West Africa. International Journal of Psychology, 2, 115-128.
- Dawson, J.L.M. (1976) Cultural and physiological influences on spatial-perceptual processes in West-Africa, Part 1. International Journal of Psychology, 1976, 2, 115-125.
- DeLacey, P.R. (1970) A cross-cultural study of classification ability in Australia. Journal of Cross-Cultural Psychology, 1, 293-304.
- Delibasi, A. (1946). Turkceden Fransizcaya buyuk lugat. Istanbul: Milli Egitim Basmevi.
- Demetriou, A. (1982) Logical and Psychological development. Contemporary Education, 8, 27-37.
- Denis, W. (1960) Causes of retardation among institutional children. Journal of Genetic Psychology, 10, 3ff.
- Derrida, J. (1978) Unity and Difference. Chicago: University of Chicago Press.
- Diebold, A.R. (1961) Incipient bilingualism. Language, 37, 97-112.

- Diller, K. (1970) "Compound" and "coordinate" bilingualism: a conceptual artifact. Word, 26, 254-261.
- Dockrell, J., Neilson, I., and Campbell, R. (1980) Conservation accidents revisited. International Journal of Behavioural Development.
- Donaldson, M. (1978) Children's Minds. London: Fontana/Croom Helm.
- Donaldson, M., and Balfour, G. (1968) Less is more: a study of language comprehension in children. British Journal of Psychology, 59, 461-472.
- Donaldson, M., and Lloyd, P. (1974) Sentences and situations: children's judgements of match and mismatch. In F. Bresson (Ed.), Problemes Actuelles en Psycholinguistics. Paris: CNRS.
- Donaldson, M., and Lloyd, P. (1974) Sentences and situations: children's judgments of match and mismatch. In Problemes Actuels de Psycholinguistique. Paris: Editions du Centre National de la Recherche Scientifique.
- Donaldson, M., and McGarrigle, J. (1974) Some clues as to the nature of semantic development. Journal of Child Language, 1, 185-194.
- Dulay, H., and Burt, M. (1974) Errors and strategies in child second language acquisition. TESOL Quarterly, 8, 129-138.
- Dulay, H., Burt, M., and Krashen, S. (1982) Language Two. Oxford: Oxford University Press.
- Duncan, S.E. and De Avila, E.A. (1979) Bilingualism and Cognition: some recent findings. NABE Journal, 4, 15-50.
- Edwards, A.D. (1976) Speech codes and speech variants: Social class and task differences in children's speech, Journal of Child Language, 3, 247-265.
- Elliot, A. and Donaldson, M. (1982) Piaget on Language. In S. Modgil and C. Modgil (eds.) J. Piaget: Consensus and Controversy New York: Holt, Rinehart and Winston.
- Ervin, S., and Osgood, C. (1954) Second language learning and bilingualism. Journal of Abnormal and Social Psychology, 49(suppl.), 139-146.
- Ervin-Tripp, S. (1968) An analysis of the interaction of language, topic and listener. In J. Fishman (Ed.), Readings in the Sociology of Language. The Hague: Mouton.

- Ervin-Tripp, S. (1974) Is second language learning like the first? TESOL Quarterly, 8, 111-127.
- Ekstrand, H.L. (1980) Bilingualism and Biculturation. International Review of Applied Psychology, Special Issue, No. 29.
- European Communities Commission (1977) The Children of Migrant Workers. Education Series No. 1. Brussels: European Economic Community.
- Fantini, A. (19) The language acquisition of the child.
- Feldman, C., and Shen, M. (1971) Some language-related cognitive advantages of bilingual 5-year-olds. Journal of Genetic Psychology, 118, 235-244.
- Ferreiro, E. (1971) Les Relations Temporelles dans le Langage de l'Enfant. Geneve: Droz.
- Fishman, J. (1965) Who speaks what language to whom and when? Linguistics, 2, 67-88.
- Forgus, R. (1955) Early visual and motor experiences as determiners of complex maze learning, Journal of Comparative Physiological Psychology, 48, 215-220.
- Fortes, M. (1938/1970) Social and Psychological aspects of education in Taleland, Africa, 1938. Reprinted: From Child to Adult: Studies in Anthropology of Education, Middleton, J. (Ed.), Garden City, N.Y.: The Natural History Press, N.Y., 1970.
- Furby, L. (1980) Implications of cross-cultural Piagetian research for cognitive developmental theory. In S. Modgil and C. Modgil (Eds.), Toward a Theory of Psychological Development. Windsor: National Foundation for Educational Research (NFER).
- Furth, H. G. (1964) Conservation of weight in deaf and hearing children. Child Development, 35, 143-150.
- Furth, H.G. (1966) Thinking Without Language. New York: Free Press.
- Gaarder, A. (1977) Language maintenance or language shift. In W. Mackey and T. Andersson (Eds.), Bilingualism in Early Childhood. Rowley, Mass.: Newbury House.
- Gal, S. (1979) Language Shift: Social Determinants of Linguistic Change in Bilingual Austria. New York: Academic Press.

- Gallagher, C. (1968) North African problems and prospects: language and identity. In J. Fishman, C. Ferguson, and J. Das Gupta (Eds.), Language Problems in Developing Nations. New York: Wiley.
- Galloway, L. (1978a) Language impairment and recovery in polyglot aphasia: a case study of a hepta-lingual. In M. Paradis (Ed.), Aspects of Bilingualism. Columbia, S.C.: Hornbeam Press.
- Galloway, L. (1978b) Cerebral Organization in Bilingualism and Second Language. Paper presented to the Second Language Research Forum, University of Southern California.
- Galloway, L. and Krashen, S.S. (1980) Cerebral organization in bilingualism and second language. In Scarcella, R. and Krashen, S.D. Research in Second Language Acquisition.
- Galloway, L.M. and Scarcella, R. (1982) Cerebral organization in adult second language organization: Is the right hemisphere involved? Brain and Language, 16(1), 56-60.
- Gardner, R., and Desrochers, A. (1981) Second language acquisition and bilingualism: Research in Canada (1970-1980). Canadian Psychology, 22(2), 146-162.
- Gardner, R., and Lambert, W. (1972) Attitudes and Motivation in Second Language Learning. Rowley, Mass.: Newbury House.
- Gay, J. H. (1969) Education and Mathematics among the Kpelle of Liberia, 1965. Paper read in Dakar, January 1969.
- Gay, J. H. and Cole, M. (1967) The New Mathematics and an old Culture. New York: Holt, Rinehart and Winston.
- Gencan, T. (1971). Dilbilgisi. Istanbul: Fen Fakultesi Basmevi.
- Genesee, F. (1978) Is there an optimal age for starting second language instruction? McGill Journal of Education, 13, 145-154.
- Genesee, F. (1980) The Social Psychological Significance of Code-Switching for Children. Unpublished manuscript, Department of Psychology, McGill University.
- Genesee, F., Hamers, J., Lambert, W., Mononen, L., Seitz, M., and Starck, R. (1978) Language processing in bilinguals. Brain and Language, 5, 1-12.
- Georgeocopoulou, (1984) Language Mixing in Greek-English Bilingual Children. Unpublished Masters thesis. Institute of Education, University of London.

- Ghuman, P. (1978) Nature of Intellectual Development of Punjabi children. International Journal of Psychology, 13-14, 281-294.
- Ghuman, P. (1982) An Evaluation of Piaget's Theory from a Cross-Cultural Perspective. In S. Modgil and C. Modgil (eds.) J. Piaget: Consensus and Controversy New York: Holt, Rinehart and Winston.
- Gibson, E. and Walk, R. (1956) Effect of prolonged exposure to visually presented patterns on discrimination learning, Journal of Comparative Physiological Psychology, 49, 239-242.
- Godel, R. (1945) Grammaire turque. Geneva: Universite de Geneve (Ecole d'interpretes).
- Goldfarb, W. (1943) Effects of early institutional care on adolescent personality, Journal of Experimental Education, 12, 106-129.
- Goldschmid, M. (1973). Cross-cultural investigation of conservation. Journal of Cross-Cultural Psychology, 4, 75-88.
- Goldstein, H. (1979) Consequences of using the Rasch model for educational assessment. British Educational Research Journal, 5, 211-220.
- Goodenough, W. H. (1971) Culture, Language and Society. (McCaleb Module in Anthropology). Reading, Mass: Addison-Wesley.
- Goodnow, J. J. (1962) A test of milieu effects with some of Piaget's tasks. Psychological Monographs, 76, whole no. 555.
- Goodnow, J. J., and Bethon, G. (1966) Piaget's tasks: the effects of schooling and intelligence. Child Development, 37, 573-582.
- Goodnow, J.J. (1973) Compensation arguments on conservation tasks. Development Psychology, 8, 140.
- Goody, G. (1978) Towards a theory of questioning. In Goody, G. (Ed.) Questions and Politeness: Strategies in Social Interaction. Cambridge: Cambridge University Press, 1978.
- Greenfield, P.M. (1966) On culture and conservation. In J. Bruner, R. Oliver, and P.M. Greenfield (Eds.), Studies in Cognitive Growth, New York: Wiley.

- Greenfield, P.M. (1976) Cross-cultural research and Piagetian theory: paradox and progress. In K. Riegel and J. Meacham (Eds.), Developing Individual in a Changing World. Hague: Mouton.
- Greenfield, P.M. and Bruner, J.S. (1969) Culture and Cognitive Growth. In D. Goslin (Ed.), Handbook of Socialization Research. New York: Rand McNally.
- Greenfield, P.M. and Childs, C. (1972) Weaving, color terms, and pattern representation: Cultural influences and cognitive development among the Zinacantecos of Southern Mexico. Paper presented at annual meetings of International Association for Cross-Cultural Psychology.
- Greenfield, P.M. and Schnieder, L. (1977) Building a tree structure: The development of hierarchical complexity and interrupted strategies in children's construction activity. Developmental Psychology, 13, 299-313.
- Grosjean, F. (1982) Life with Two Languages: An Introduction to Bilingualism. Cambridge, Mass.: Harvard University Press.
- Gruen, G.E. (1966) Note on conservation: definitional and methodological considerations. Child Development, 37, 977-983.
- Gumperz, J. (1969) Communication in multilingual societies. In S.A. Tyler (Ed.) Cognitive Anthropology. New York: Holt, Rinehart, and Winston.
- Gumperz, J. (1970) Verbal strategies in multilingual communication. In J. Alatis (Ed.), Bilingualism and Language Contact. Washington, D.C.: Georgetown University Press.
- Gumperz, J. (1976) The sociolinguistic significance of conversational code-switching. In J. Cook-Gumperz and J. Gumperz (Eds.), Papers on Language and Context. Working papers of the language behavior research laboratory. University of California, Berkeley.
- Gumperz, J. and Hernandez-Chavez, E. (1970) Cognitive aspects of bilingual education. In W. Whiteley (Ed.), Language Use and Social Change. Oxford: Oxford University Press.
- Gumperz, J. and Hernandez-Chavez, E. (1978) Bilingualism, bidialectism, and classroom interaction. In M. Lourie and N. Conklin (Eds.), A Pluralistic Nation. Rowley, Mass.: Newbury House.

- Hams, T.M. (1976) Assessing the Scholastic Achievement and cognitive development of bilingual and monolingual children. In Simoes, A. (Ed.) Educational Psychology. New York: Academic Press.
- Hansegard, N.E. (1968) Tvasprakighet eller halvsprakighet? [Summarised in T. Husen and S. Oppen (1983), Multicultural and Multilingual Education in Immigrant Countries. London: Pergamon Press.]
- Harris, P.L. (1975) Inferences and Semantic Development. Journal of Child Language, 2, 143-152.
- Haugen, E. (1953) The Norwegian Language in America. Two volumes. Philadelphia: University of Pennsylvania Press.
- Haugen, E. (1956) Bilingualism in the Americas: a Bibliography and Research Guide. Alabama: University of Alabama Press.
- Haugen, E. (1978) International Dimensions of Bilingual Education. Georgetown University Roundtable on Languages and Linguistics. Washington D.C.: Georgetown University.
- Hebb, D. (1949) The Organization of Behavior. New York: Wiley.
- Hebb, D. (1958) Motivating effects of exteroceptive stimuli. American Psychologist, 13, 109ff.
- Heider, F.K. and Heider, G.M. (1950) A comparison of color sorting behavior of deaf and hearing children. Psychological Monographs, 52, 6-22.
- Hendrick, I. (1942) Instinct and Ego during infancy, Psychoanalytic Quarterly, 11, 33-58.
- Henicke, C. (1953) Some antecedents and correlates of Guilt and Fear in Young Boys, Unpublished Ph.D. dissertation, Boston: Harvard University.
- Heron, A. (1971) Concrete operations, 'g' and achievement in Zambian children. Journal of Cross-Cultural Psychology, 2, 326-336.
- Heron, A. (1974) Cultural determinants of concrete operational behaviour. In J.L.M. Dawson and W.J. Lonner, Readings in Cross-Cultural Psychology. Hong Kong: University Press.
- Heron, A. and Dowel, W. (1973) Weight conservation and matrix solving ability in Papuan children. Journal of Cross-Cultural Psychology, 4, 207-219.

- Heron, A. and Dowel, W. (1974) The questionable unity of the concrete operations stage. International Journal of Psychology, 2, 1-9.
- Heron, A., Gardner, L. and Grieve, N. (1977) Concrete operational development in Yugoslav migrant children. In Y. Poortinga, Basic Problems in Cross-Cultural Psychology. Amsterdam: Swets and Zeitlinger.
- Heron, A. and Kroeger, E. (1975) The effects of training on uneven concrete operational development in Yugoslav migrant children. In J.W. Berry and W.J. Lonner (Eds.), Applied Cross-Cultural Psychology. Amsterdam: Swets and Zeitlinger.
- Heron, A. and Simonsson, M. (1969) Weight conservation in Zambian children. International Journal of Psychology, 4, 281-292.
- Hill, H.S. (1936) Correlation between IQs of bilinguals at different ages on different intelligence tests. Schools and Society, 44, 59-90.
- Hony, H. (1967). Turkish-English dictionary. (2nd edition) Oxford: Oxford University Press.
- Hony, H. with Iz, F. (1962), A Turkish English Dictionary. London: Oxford University Press.
- Hufner, K. (1972) Education to meet migrant worker's problems. UNESCO Features, No. 162. Paris: United Nations Educational, Scientific and Cultural Organization.
- Hughes, M. and Grieve, R. (1980) On asking children bizarre questions. Language, 1, 1980.
- Hyde, D. (1959). An investigation of Piaget's theories of the development of the concept of number. Ph.D. dissertation, University of London.
- Hyde, D. M. G. (1970) Piaget and Conceptual Development. London: Holt, Rinehart and Winston.
- Hymes, D. (1974) Speech and Language: on the origins and foundations of inequality among speakers. In M. Bloomfield et al. (Eds.), Language as a Human Problem. New York: W.W. Norton.
- Ianco-Worrall, A. (1972) Bilingualism and cognitive development. Child Development, 43, 1390-1400.

- Imedadze, N., and Uznadze, D. (1978) On the psychological nature of child speech formation under condition of exposure of two languages. In E. Hatch (Ed.), Second Language Acquisition. Rowley, Mass.: Newbury House.
- Inhelder, B. (1982) Outlook. In S. Modgil and C. Modgil (eds.) J. Piaget: Consensus and Controversy New York: Holt, Rinehart and Winston.
- Inhelder, B., and Piaget, J. (1958) The Growth of Logical Thinking. London: Routledge and Kegan Paul.
- Inhelder, B., and Piaget, J. (1959) La Genese des Structures Logiques Elementaires. Neuchatel: Delachaux and Niestle. English edition (1964) The Early Growth of Logic in the Child. London: Routledge and Kegan Paul.
- Inhelder, B., and Piaget, J. (1964) The Early Growth of Logic in the Child. London: Routledge and Kegan Paul.
- Inhelder, B., Sinclair, H., and Bovet, M. (1974) Learning and the Development of Cognition. London: Routledge and Kegan Paul.
- Ironsmith, M. and Whitehurst, G. (1978) The development of listener abilities in communication: how children deal with ambiguous information. Child Development, 49, 348-352.
- Jakobovits, L., and Lambert, W. (1961) Semantic satiation among bilinguals. Journal of Experimental Psychology, 62, 576-582.
- James, C.. (1958) Bilingualism and verbal reasoning. Bulletin No. 5, University College, Faculty of Education, Aberystwyth, Wales.
- James, C. (1960) Bilingualism in Wales: an aspect of semantic organisation. Educational Research, 82, 3-9.
- James, C. (1980) Contrastive Analysis. London: Longman and Harlow.
- John, V. (1970) Cognitive Development in the bilingual child in J.E. Alatis (Ed.), Monograph Series on Languages and Linguistics. No. 23. Washington D.C.: Georgetown University School of Languages and Linguistics.
- Jones, W.R. (1952) The language handicap of Welsh-speaking children. British Journal of Educational Psychology, 22, 114-123.

- Jones, W.R. (1953) The handicap of Welch-speaking children: a study of their performance in an English verbal intelligence test in relation to their non-verbal ability and their reading ability. British Journal of Educational Psychology, 23, 114-120.
- Kavanaugh, R.D. (1976) On the Synonymity of More and Less: Comments on a Methodology. Child Development, 47, 885-887.
- Kelley, M., Tenezakis, M. and Huntsman, R. (1973) Some unusual conservation behavior in children exposed to two cultures. British Journal of Educational Psychology, 43, 181-182.
- Kellner, M. and Tanner, M. (1958) Effects of early deprivation on Speech development. Language and Speech, 1, 269-287.
- Kessler, C. and Quinn, M.E. (1980) Positive effects of bilingualism on science problem solving abilities. In Alatis, J. (Ed.), Georgetown University Round Table on Languages and Linguistics, 1980. Washington D.C.: Georgetown University Press.
- Kiel, F.C. (1979) Semantic and Conceptual Development: An Ontological Perspective. Cambridge, Mass.: Harvard University Press.
- Kinsbourne, M. (1981) Neuropsychological aspects of bilingualism. Annals of the New York Academy of Sciences, 379, 50-58.
- Kirk, L. (1976) Cross cultural measurement of maternal behavior in mother-child teaching interaction, Quality and Quantity, 10, 127-143.
- Kittell, J.E. (1959) Bilingualism and language - non-language intelligence scores of third grade children. Journal of Educational Research, 52, 263-268.
- Kittell, J.E. (1963) Intelligence-best performance of children from bilingual environments Elementary School Journal, 64, 76-83.
- Klahr, D. (1969). A Monte Carlo investigation of the statistical significance of Kruskal's nonmetric scaling procedure. Psychometrika, 34, 319-330.
- Kohn, M. (1959) Social class and the exercise of parental authority. American Sociological Review, 19, 353-366.
- Kollers, P. (1963) Interlingual word associations. Journal of Verbal Learning and Verbal Behavior, 2, 291-300.

- Kolers, P. (1978) On the representations of experience. In D. Gerver and H. Sinaiko (Eds.), Language Interpretation and Communication. New York: Plenum Press.
- Kolers, P. and Gonzalez, E. (1980) Memory for words, synonyms, and translations. Journal of Experimental Psychology: Human Learning and Memory, 6(1), 53-65.
- Krashen, S. (1973) Lateralization, language learning and the critical period: some new evidence. Language Learning, 23, 63-74.
- Krashen, S. (1976) Cerebral Asymmetry. In H. Whitaker and H.A. Whitaker, Studies in Neurolinguistics, Volume 2, New York: Academic Press.
- Krashen, S. (1978) The monitor model for second language acquisition. In R. Gingras (Ed.), Second Language Acquisition and Foreign Language Teaching. Arlington, Va.: Center for Applied Linguistics.
- Krashen, S. (1982) Child-adult differences in Second Language Acquisition. Powley, Mass.: Newbury House.
- Krashen, S., and Scarcella, R. (1978) On routines and patterns in language acquisition and performance. Language Learning, 28, 283-300.
- Kruskal, J. (1964). Nonmetric multidimensional scaling: a numerical method. Psychometrika, 29, 28-42.
- Lado, R. (1957) Linguistics Across Cultures. Ann Arbor, Michigan: University of Michigan Press.
- Lambert, W.E. (1975)
- Lambert, W.E. (1978) Some Cognitive and Sociocultural Consequences of Being bilingual. In Hornby (Ed.) International Dimensions of Bilingual Education.
- Lambert, W.E. (1981) Bilingualism and language acquisition. Annals of the New York Academy of Sciences, 379, 9-22.
- Lambert, W.E. (1983) Deciding on language instruction: psychological and social considerations. Multicultural and Multilingual Education in Immigrant Countries. London: Pergamon Press.
- Lambert, W.E., Havelka, J., and Crosby, C. (1958) The influence of language acquisition contexts on bilingualism. Journal of Abnormal and Social Psychology, 56, 239-244.

- Lambert, W.E., and Macnamara, J. (1969) Some cognitive consequences of following a first grade curriculum in a second language. Journal of Educational Psychology. 60, 89-96.
- Lambert, W.E. and Moore, N. (1966) Word Association responses: comparison of American and French monolinguals with Canadian monolinguals and bilinguals. Journal of Personality and Social Psychology, 3, 313-320.
- Lambert, W.E. and Tucker, G.R. (1973) Benefits of Bilingualism. Psychology Today, 6, September, pp. 89ff.
- Lambert, W.E. and Tucker, G.R. (1976) Bilingual Education of Children: The St. Lambert Experiment. Rowley, Mass.: Newbury House.
- Landy, R. (1974) A comparison of second language learners and Monolinguals on divergent thinking tasks at elementary school level. Modern Language Journal, 58, 10-15.
- Laurendeau, M. and Pinard, A. (1963) Causal Thinking in the Child. New York: International Universities Press.
- Laurendeau, M. and Pinard, A. (1970) Development of the Child's Conception of Space. New York: International Universities Press.
- Laurendeau - Ben David, M. (1977) Culture, schooling, and cognitive development: A comparative study of children in French Canada and Rwanda. In P. Dasen (Ed.), Cross-Cultural Contributions. New York: Gardner Press.
- Lennenberg, E. (1967) Biological Foundations of Language. New York: Wiley.
- Leonard, L.B. and Weiss, A.L. (1983) Application of nonstandardized assessment procedures to diverse linguistic populations. Topics in Language Disorders, 3, 35-45.
- Leontiev, A. (1963). Principles of mental development and the problem of intellectual backwardness. In B. Simon and J. Simon (Eds.), Educational psychology in the U.S.S.R. London: Routledge and Kegan Paul.
- Leopold, W. (1939) Vocabulary Growth in the First Two Years. Volume 1 in Speech Development of a Bilingual Child: A Linguist's Record. Evanston, Ill.: Northwestern University Press.

- Leopold, W. (1947) Sound Learning in the First Two Years.
Volume 2 in Speech Development of a Bilingual Child: A Linguist's Record. Evanston, Ill.: Northwestern University Press.
- Leopold, W. (1949a) Grammar and General Problems in the First Two Years. Volume 3 in Speech Development of a Bilingual Child: A Linguist's Record. Evanston, Ill.: Northwestern University Press.
- Leopold, W. (1949b) Diary from Age Two. Volume 4 in Speech Development of a Bilingual Child: A Linguist's Record. Evanston, Ill.: Northwestern University Press.
- Leopold, W. (1961) Patterning in children's language learning. In S. Saporta (Ed.), Psycholinguistics. New York: Holt, Rinehart, and Winston.
- Leopold, W. (1970) Speech Development of a Bilingual Child. New York: Wiley.
- Leopold, W. (1978) A child's learning of two languages. In E. Hatch (Ed.), Second Language Acquisition, Rowley, Mass.: Newbury House.
- Lerner, D. (1958) The Passing of Traditional Society: Modernizing the Middle East. Gelncoe, Illinois: Free Press.
- Levy, R. (1957) The Social Structure of Islam. Cambrdige: Cambridge University Press.
- Lewis, D.G. (1959) Bilingualism and non-verbal intelligence: a further study of test results. British Journal of Educational Psychology, 29, 17-22.
- Lewis, G. (1967). Turkish grammar. Trans. T., Oxford: Oxford University Press.
- Lezak, M.D. (1976) Neuropsychological Assessment. Oxford: Oxford University Press.
- Liedke, W. and Nelson, L. (1968) Concept formation and bilingualism. Alberta Journal of Educational Research, 14, 225-232.
- Light, P.H., Buckingham, N., and Robbins, A.H. (1979) The conservation task as an interactional setting. British Journal of Educational Psychology, 49, 304-310.
- Lipski, J. (1978) Code switching and the problem of bilingual competence. In M. Paradis (Ed.), Aspects of Bilingualism. Columbia, S.C.: Hornbeam Press.

- Lloyd, B. B. (1971) Studies of conservation with Yoruba children of differing ages and experience. Child Development, 42, 415-428.
- Lloyd, B. B. (1971) The intellectual development of Yoruba children: a reexamination. Journal of Cross-Cultural Psychology, 2, 29-38.
- Lloyd, P. (1975) Communication in Preschool Children. Unpublished doctoral thesis, University of Edinburgh.
- Lofgren, H. and Ouvinen-Birgerstam, P. (1982) A bilingual model for the teaching of immigrant children. Journal of Multilingual and Multicultural Matters, 3, 323-331.
- Loman, B. (1974) Sprak och Samhalle, 2. Spraket i Tornedalen. [Summarised in T. Husen and S. Oppen (1983), Multicultural and Multilingual Education in Immigrant Countries. London: Pergamon Press.]
- Luria, A. (1960) Role of Speech in the formation of mental processes. London: Pergamon.
- Luria, A.R. (1976) Cognitive Development: Its Cultural and Social Foundations. Cambridge, Mass.: Harvard University Press.
- MacArthur, R.S. (1973) Some Ability Patterns: Central Eskimos and Nsenga Afrikans. International Journal of Psychology, 8, 239-247.
- MacArthur, R. S. (1975) Ecology, culture and cognitive development: Canadian native youth. Driedge, M. L. (Ed.) The Canadian Ethnic Mosaic: A Guest for Identity. Englewood Cliffs, N.J.: Prentice Hall, 1975.
- Mackey, W. (1970) Interference, integration, and the synchronic fallacy. In J. Alatis (Ed.), Bilingualism and Language Contact. Washington D.C.: Georgetown University Press.
- Mackey, W.F. (1970) The description of bilingualism. In J. Fishman (Ed.) Readings in the Sociology of Language. The Hague: Mouton.
- Macnamara, J. (1966) Bilingualism and Primary Education: A Study of the Irish Experience. Edinburgh: University of Edinburgh Press.
- Macnamara, J. (1969) How can one measure the extent of a person's bilingual proficiency? In L. Kelley (Ed.), Description and Measurement of Bilingualism. Toronto: University of Toronto Press.

- Macnamara, J. (1970) Bilingualism and thought. In J. Alatis (Ed.), Bilingualism and Language Contact. Washington, D.C.: Georgetown University Press.
- Malmberg, B. (1971) Sprakinlarning. En Orientering och ett Debattinlägg. [Summarised in T. Husen and S. Oppen (1983), Multicultural and Multilingual Education in Immigrant Countries. London: Pergamon Press.]
- Mansfield, A.F. (1977) Semantic organization in the young child: Evidence for the development of semantic feature systems. Journal of Experimental Child Development, 23, 57-77.
- Markman, E. (1973) The facilitation of part-whole comparisons by use of collective noun "family" Child Development, 44, 837-840.
- Markham, E. and Siebert, J. (1976) Class and collections: internal organization and resulting holistic properties. Cognitive Psychology, 8, 561-577.
- McBride, J. (1967) Study of the self concepts of 7th Grade disadvantaged children and certain counseling and motivational techniques. Unpublished D.Ed. thesis, Arizona State University.
- McClure, E. (1977) Aspects of Code-Switching in the Discourse of Bilingual Mexican-American Children. Technical report no. 44. Center for the Study of Reading, University of Illinois at Urbana-Champaign.
- McGarrigle, J., and Donaldson, M. (1975) Conservation accidents. Cognition, 3, 341-350.
- McLaughlin, B. (1977) Second language learning in Children. Psychological Bulletin, 84(3), 438-459.
- McLaughlin, B. (1978) Second Language Acquisition in Childhood. Hillsdale, New Jersey: Lawrence Erlbaum Associates.
- McLaughlin, B. (1984) Early bilingualism: methodological and theoretical issues. In Y. Lebrun and M. Paradis (Eds.), Early Bilingualism and Child Development. Amsterdam: Swets and Zeitlinger.
- McNab, G. (1979) Cognition and bilingualism. Linguistics, 17, 231-255.
- Meadows, S. (1983) Developing Thinking. New York: Methuen.
- Menges, K. (1968). The Turkic languages and peoples. Wiesbaden: Harrasowitz.

- Metall, I.G. (1970) Zur schulischen Integration der Kinder Ausländischer Arbeitnehmer. Frankfurt Am Main: I.G. Metall, mimeographed.
- Miller, D. and Swanson, G. (1966) Inner Conflict and Defense. New York: Shocken.
- Milner, B., Taylor, L. and Sperry, R. (1968) Lateralized suppression of dichotically presented digits after commissural section in man. Science, 161, 184-186.
- Modgil, S. and Modgil, C. (1976) Piagetian Research: Compilation and Commentary: Vol. 8: Cross-Cultural Studies. Windsor: NFER.
- Moore, E.T. and Harris, E.A. (1977) Language and Thought in Piagetian Theory. Alternatives to Piaget: Critical Essays on the Theory. In L. Siegel and C. Brainerd (Eds.), New York: Academic Press.
- Mundy-Castle, A.C. Social and technological intelligence in Western and non-Western cultures. Universita, 4, 46-52.
- Murray, F.B. and Tyler, S.J. (1978) Semantic characteristics of the conservation transformation. Psychological Reports, 42, 1051-1054.
- Myers, B. and Goldstein, D. (19) Cognitive development in bilingual and monolingual lower-class children. Psychology in the Schools, 16(1), 137-142.
- Neilson, I., Dockrell, J., and Campbell, R. (1979) Conservation Accidents Revisited. Paper presented at the British Psychology Society--Developmental Section--Symposium, University of Southampton.
- Neilson, I., Dockrell, J., and McKechnie, J. (1980) Context and Cognition. Unpublished ms.
- Nemeth, G. (1916). Türkische grammatik. Berlin: G. J. Goschen.
- Nemeth, G. (1962) Turkish Grammar. Translated by Halasi-Kun, T. Gluckstadt: Mouton.
- Nyrop RF (1979) et al. Area Handbook for Turkey
Washington D.C. Government Printing Office
- O'Doherty, E.F. (19) Bilingualism: Educational aspects. Advancement of Science, 56, 282-287.
- Ojemann, G. A. and Whitaker, H. A. (1978) The bilingual brain. Archives of Neurology, 35(7), 409-412.

- Okonji, M. (1971) Cross-cultural study of the effects of familiarity of classificatory behaviour. Journal of Cross-Cultural Psychology, 2, 39-46.
- Okonji, M. (1971) Cross-cultural study of the effects of familiarity on classificatory behavior. Journal of Psychology, 6, 39-49.
- Okonji, M. (1971) Culture and children's understanding of geometry. International Journal of Psychology, 6, 121-128.
- Oksaar, E. (1971) Code switching as an interactional strategy for developing bilingual competence. Word, 27, 377-385.
- Oksaar, E. (1983) Multilingualism and Multiculturation: methodological and theoretical considerations. In T. Husen and T. Oppen (Eds.), Multicultural and Multilingual Education in Immigrant Countries. London: Pergamon.
- Oleron, P. (1951) Pensée conceptuelle et langage: Performances comparées des sourds-muets. L'Année Psychologique, 52, 47-81
- Oleron, P. (1977) Language and Mental Development. Hillsdale, New Jersey: Lawrence Earlbaum Associates.
- Oleron, P., and Herren, H. (1961) L'acquisition des conservations et le langage. Enfance, 4, 201-219.
- Olson, D.R. and Torrance, N.G. (1983) Literacy and cognitive development: a conceptual transformation in the early school years. In S. Meadows (Ed.), Developing Thinking. New York: Methuen.
- Olton, R. (1960) Semantic Generalization between Languages. Unpublished Masters thesis, McGill University. (Summarized in F. Grosjean, Life with Two Languages. Cambridge, Mass.: Harvard University Press.)
- Oppen, S. (1977) Concept development in Thai urban and rural children. In P.R. Dasen (Ed.), Piagetian Psychology: Cross-cultural Contributions. New York: Gardner Press.
- Oren, D. L. (1981) Cognitive advantages of bilingual children related to labeling ability. Journal of Educational Research, 74(3), 163-169.
- Izzo, G. (1983) Patterns of Interaction of the Bilingual Child Unpublished Masters thesis. Institute of Education, University of London.

- Overton, W.F. (1976) The active organism in structuralism. Human Development, 19, 71-86.
- Padilla, A., and Liebman, E. (1975) Language acquisition in the bilingual child. The Bilingual Review/La Revista Bilingue, 1-2, 34-55.
- Paine, S.H. (1974) Exporting Workers: the Turkish case. Cambridge: Cambridge University Press.
- Paivio, A., and Desrochers, A. (1980) A dual-coding approach to bilingual memory. Canadian Journal of Psychology. 34(4), 388-399.
- Paradis, M. (1977) Bilingualism and aphasia. In H. Whitaker and H. Whitaker (Eds.), Studies in Neurolinguistics, Volume 3. New York: Academic Press.
- Paradis, M. (1980) The language switch in bilinguals: psycholinguistic and neurolinguistic perspectives. In P. Nelde (Ed.), Language in Contact and Conflict. Wiesbaden: Franz Steiner Verlag.
- Paulston, C.B. (1975) Ethnic relations and bilingual education: accounting for contradictory data. Working Papers on Bilingualism, 6, 1-44.
- Paulston, C.B. (1978) Bilingual and bicultural education. In L. Schulman (Ed.), Review of Research in Education. Itasca, Illinois: Peacock.
- Paulston, C.B. (1980) Bilingual Education: Theories and Issues. Powley, Mass.: Newbury House.
- Peal, E., and Lambert, W. (1962) The relation of bilingualism to intelligence. Psychological Monographs, 76, whole no. 546.
- Peluffo, N. (1962) Les notions de conservation et de causalite chez les enfants provenant de differents milieux physiques et socio-culturels. Archives de Psychologie, 38, 275-291.
- Peluffo, N. (1964) Culture and cognitive problems. International Journal of Psychology, 2, 167-198.
- Penninx, R. (1983) A Critical Review of Theory and Practice: the case of Turkey. International Migration Review, 16, 781-818.
- Pettifor, J.L. (1968) The role of language in the development of abstract thinking: a comparison of hard-of-hearing and normal-hearing children on level of conceptual skill. Canadian Review of Psychology, 22, 139-156.

- Piaget, J. (1923) Le Langage et la Pensee Chez l'Enfant. Neuchatel: Delachaux and Niestle. English edition (1926) The Language and Thought of the Child. London: Routledge and Kegan Paul.
- Piaget, J. (1924) Le Jugement et la Raisonnement Chez l'Enfant. Neuchatel: Delachaux and Niestle. English edition (1926) Judgment and Reasoning in the Child. New York: Harcourt and Brace.
- Piaget, J. (1926) Language and Thought of the Child. London: Routledge and Kegan Paul.
- Piaget, J. (1928) Judgement and Reasoning in the Child. London: Routledge and Kegan Paul.
- Piaget, J. (1949) Traite de Logique, Paris: Librarie Armand Colin.
- Piaget, J. (1951) Play, Dreams and Imitation in Childhood. New York: Norton.
- Piaget, J. (1952) The Child's Conception of Number. London: Routledge and Kegan Paul.
- Piaget, J. (1952) The Origins of Intelligence in Children. New York: International University Press.
- Piaget, J. (1953) Logic and Psychology. Manchester: Manchester University Press.
- Piaget, J. (1954) The Construction of Reality in the Child. New York: Basic Books.
- Piaget, J. (1954) Le langage et la pensee du point de vue genetique. In G. Revesz (Ed.), Thinking and Speaking. Amsterdam: North Holland Publishing.
- Piaget, J. (1956) Problemes de Psychologie Genetique. Moscow: Voprossi Psikhologii.
- Piaget, J. (1961) Les Mecanismes Perceptifs: Modeles Probabilistes, Analyse Genetique, Relations avec l'Intelligence. Paris: PUF.
- Piaget, J. (1963) Le langage et les operations intellectuelles. In J. de Ajuriaguerra, F. Bresson, P. Fraisse, B. Inhelder, P. Oleron, and J. Piaget, Problemes de Psycholinguistique. Paris: PUF.
- Piaget, J. (1964/1967) Six Etudes de Psychologie. Geneve: Gonthier. English edition (1967) Six Psychological Studies. New York: Random House.

- Piaget, J. (1966) Necessite et signification de recherches comparatives en psychologie genetique. International Journal of Psychology, 1, 1-13.
- Piaget, J. (1968) Le Structuralisme. Paris: PUR:(Que sais-je). English edition (1971) Structuralism. London: Routledge and Kegan Paul.
- Piaget, J. (1970) Genetic Psychology. New York: Columbia University Press.
- Piaget, J. (1971a) Biology and Knowledge. Edinburgh: Edinburgh University Press.
- Piaget, J. (1971b) Structuralism. London: Routledge and Kegan Paul.
- Piaget, J. (1975) L'Equilibration des Structures Cognitives: Probleme Central du Developpement. Paris: PUF.
- Piaget, J. (1975) Correspondences and Transformations. Presentation at Fifth Annual Meeting of the Jean Piaget Society, Philadelphia.
- Piaget, J. (1978) Success and Understanding, London, Routledge and Kegan Paul.
- Piaget, J. and Inhelder, B. (1941). Le developpement des quantites chez l'enfant. Neuchatel: Delacheux et Niestle.
- Piaget, J. and Inhelder, B. (1968) Memoire et Intelligence. Paris: Presses Universitaires de France.
- Piaget, J., and Inhelder, B. (1956) The Child's Conception of Space. London: Routledge and Kegan Paul.
- Piaget, J., and Inhelder, B. (1966) La Psychologie de l'Enfant. Paris: PUF:(Que sais-je). English edition (1969) The Psychology of the Child. New York: Routledge and Kegan Paul/Basic Books.
- Piaget, J., and Inhelder, B. (1969) The Psychology of the Child. London: Routledge and Kegan Paul.
- Piaget, J., et al. (1977) Recherches sur l'Abstraction Reflechissante, Volumes 1-2. Paris: PUF.
- Piaget, J., Inhelder, B., and Szeminska, A. (1960) The Child's Conception of Geometry. London: Routledge and Kegan Paul.

- Pitnerm R. and Keller, R. Intelligence of foreign children. Journal of Educational Psychology, 31, 255-263.
- Pohl, J. (1965) Bilingualismes. Revue Roumaine de Linguistique, 10, 343-349. (Summarized in T. Skutnabb-Kangas (1983) Bilingualism or Not: The Education of Minorities. London: Multicultural Matters, Ltd.)
- Poplack, S. (1979) "Sometimes I'll start a sentence in Spanish y termino in Espanol: toward a typology of code switching. Centro de Estudios Puertorriquenos Working Papers, 10, 1-43. (Summarized in F. Grosjean, Life with Two Languages. Cambridge, Mass.: Harvard University Press.)
- President's Commission on Foreign Languages and International Studies (1979a) Strength through Wisdom: a critique of U.S. capability. Washington D.C.: Government Printing Office.
- President's Commission on Foreign Languages and International Studies (1979b) Background Papers and Studies. Washington D.C.: Government Printing Office.
- Price-Williams, D. (1961) A study concerning concepts of number among primitive children. Acta Psychologica, 18, 293-305.
- Price-Williams, D.R., Gordon, W., and Ramirez, M. (1969) Skill and Conservation: A Study of pottery-making children. Developmental Psychology, 1, 769.
- Rabain-Zempleni, J. (1965) Quelques reflexions sur les modes fondamentaux de relations chez l'enfant Wolof du sevrage a l'integration dans la classe. Paris: Association Universitaire pour le Developpement de L'Enseignement et de la culture en Afrique et Madagascar.
- Rist, R.C. (1978) The education of guestworker children: the Federal Republic of Germany. Integrated Education, 16, 6-9.
- Rist, R.C. (1979) Migration and Marginality: Guestworkers in Germany and France. Daedalus, 95-108.
- Rist, R.C. (1979) On the education of guest-worker children in Germany: a comparative study of policies and programs in Bavaria and Berlin. School Review, 87, 242-268.
- Rist, R.C. (1979) On the education of guest-worker children in Germany: public policies and equal educational opportunity. Comparative Education Review, 23, 355-369.
- Rogoff, B. (1980) Schooling and the development of cognitive skills. In H. Triandis and A. Heron (Eds.), Handbook of Cross-Cultural Psychology, Volume 4. Boston: Alwyn and Bacon.

- Rosch, E., Mervis, C.B., Grey, W.D., Johnson, D.M., and Boyes-Bream, P. (1976) Basic objects in natural categories. Cognitive Psychology, 8, 382-389.
- Rose, S.A. (1973) Acquiescence and conservation. Child Development, 44, 811-814.
- Rose, S.A., and Blank, M. (1974) The potency of context in children's cognition: an illustration through conservation. Child Development, 45, 499-502.
- Rosenthal, D.A. (1979) Language skills and formal operations. Merrill-Palmer Quarterly, 25, 133-143.
- Rothenberg, B.B. (1969) Conservation of number among 4 and 5 year old children. Child Development, 40, 383-406.
- Saer, J. (1923) Effects of bilingualism on Intelligence. British Journal of Educational Psychology, 14, 25-38.
- Samuel, J. and Bryant, P. (1984) Asking only one question in the Conservation Experiment. Journal of Child Psychology and Psychiatry, 25, 315-318.
- Scribner, S. and Cole, M. (1981) The Psychology of Literacy. Cambridge, Mass.: Harvard University Press.
- Segal, M. Campbell, D. T., Herkowitz, M. J. (1966) The Influence of Culture on Visual Perception. Indianapolis: Bobbs-Merrill.
- Segalowitz, N. (1977) Psychological perspectives on bilingual education. In B. Spolsky and R. Cooper (Eds.), Frontiers of Bilingual Education. Rowley, Mass.: Newbury House.
- Seliger, H. (1978) Implications of a multiple critical periods hypothesis for second language learning. In W. Ritchie (Ed.), Second Language Acquisition Research. New York: Halstead Press.
- Seliger, H. (1980) Strategy and Tactic in Second Language Acquisition. Paper presented at Los Angeles Second Language Research Forum.
- Selinker, L. (1972) Interlanguage. International Review of Applied Linguistics, 10, 209-231.
- Sevino, M., and Turner, C.F. (1976) Language and the latent structure of cognitive development. International Journal of Psychology, 11 (4), 231-250.

- Shalaby, A. (1954) History of Muslim Education. Beirut: Dar Al-Kashshaf.
- Shayer, M., Demtriou, A., and Pervez, M. (1985) The Structure and Sclaing of Concrete Operational Thought. Unpublished manuscript. Centre for Science and Methematics Education, Chelsea College, University of London.
- Siegel, L. S. (1971) The development of the understanding of certain number concepts. Developmental Psychology, 5(2), 362-363.
- Siegel, L. S. (1971) The sequence of development of certain number concepts in preschool children. Developmental Psychology, 5(2), 357-361.
- Siegel, L. S. (1972) Development of the concept of seriation. Developmental Psychology, 6(1), 135-137.
- Siegel, L.S. The relationship of language and thought in the pre-operational child. Alternatives to Piaget: Critical Essays on the Theory. New York: Academic Press.
- Siegel, L.S. (1977) Is the young child really preoperational or the relationship of language and thought in the preoperational child: a reconsideration of nonverbal approaches to Piagetian tasks. In L.S. Siegel, and C.J. Brainerd (Eds.), Alternatives to Piaget: Critical Essays on Theory. New York: Academic Press.
- Siegel, L.S., and Goldstein, A. G. (1969) Conservation of number in young children: recency versus relational response strategy. Developmental Psychology, 1, 128-130.
- Siegel, L.S. and Hodgim B. (1982) The Garden Path to the Understanding of Cognitive Development: Has Piaget Led us into the Poison Ivy? In S. Modgil and C.Modgil (eds.) Jean Piaget: Consensus and Controversy. New York: Holt, Rinehart and Winston.
- Sinclair de Zwart, H. (1967) Acquisition du langage et developpement de la pensee. Paris: Dunod.
- Sinclair de Zwart, H. (1969) Developmental psycholinguistics. In D. Elkind and J. Flavell (Eds.), Studies in Cognitive Development. New York: Oxford University Press.
- Sinclair, H. (1973) Language acquisition and cognitive development. In T.E. Moore (Ed.), Cognitive Development and the Acquisition of Language. New York: Academic Press.

- Sinclair, H. (1975) The role of cognitive structures in language acquisition. In E.H. Lennenberg, and E. Lennenberg, Foundations of Language Development, Volume 1. New York: Academic Press.
- Sinclair, H. (1978) The Child's Conception of Language.
- Sinclair, H. (1982) Piaget on Language: A Perspective. In S. Modgil and C. Modgil (eds.) Jean Piaget: Consensus and Controversy New York: Holt, Rinehart and Winston.
- Skinner, B. (1953) Science and Human Behavior. New York: McMillan.
- Skuse, D. (1984a) Extreme deprivation in Early Childhood, I: Diverse outcomes for three siblings from an extraordinary family. Journal of Child Psychology and Psychiatry, 25, 523-541.
- Skuse, D. (1984b) Extreme deprivation in Early Childhood, II: Theoretical issues and a comparative review. Journal of Child Psychology and Psychiatry, 25, 543-572.
- Skutnabb-Kangas, T. (1981) Guest worker or immigrant--different ways of reproducing an underclass. Journal of Multilingual and Multicultural Development, 2, 89-115.
- Skutnabb-Kangas, T. (1983) Bilingualism or Not: The Education of Minorities. London: Multicultural Matters, Ltd.
- Skutnabb-Kangas, T., and Toukomaa, P. (1976) Teaching Migrant Children's Mother Tongue and Learning the Language of the Host Country in the Context of the Socio-Cultural Situation of the Migrant Family. Helsinki: Finnish National Commission for UNESCO.
- Slobin, D. (1973) Cognitive prerequisites for the development of grammar. In C. Ferguson and D. Slobin (Eds.), Studies of Child Language Development. New York: Holt, Rinehart and Winston.
- Slobin, D. (1979) Psycholinguistics. 2nd Edition / San Francisco Scott, Foresman
- Smeldsund, J. (1963) The development of concrete transitivity of length in children. Child Development, 34, 389-405.
- Soares, L. and Grosjean, F. (1981) left hemisphere language lateralization in bilinguals and monolinguals. Perception and Psychophysics, 29, 599-604.
- Spitz, R. (1949) The role of ecological factors in emotional development in infancy, Child Development, 20, 145-156.

- Spradley, J.P. (1972) Foundations of cultural knowledge in culture and cognition: Rules, Maps and Plans. San Francisco, Calif: Chandler.
- Springer, S. P. and Deutsch, G. (1985) Left Brain, Right Brain. Revised edition. New York: W.H. Freeman
- Stark, W.A. (1940) The effect of bilingualism on general intelligence: an investigation carried out in certain Dublin primary schools. British Journal of Educational Psychology, 10, 78-79.
- Steinberg, ? and Anderson, ? (1975) Hierarchical semantic organization in six year olds. Journal of Experimental Child Development, 19, 544-553.
- Stone, L. and Church, J. (1968) Childhood and Adolescence. New York, 1968.
- Strauss, S., and Kroy, M. (1977) The child as logician or methodologist? A critique of formal operations. Human Development. 20(2), 102-117.
- Swain, M. (1972) Bilingualism as a First Language. Ph.D. dissertation, University of California at Irvine.
- Swain, M., and Cummins, J. (1979) Bilingualism, cognitive functioning and education. Language Teaching and Linguistics: Abstracts, 12, 4-18.
- Szyliowicz, A. (1973) Education and Modernization in the Middle East. Ithaca, N.Y.: Cornell University Press.
- Templin, M. (1957) Development of certain language skills in children. Minneapolis: University of Minnesota Press, 1957.
- Thiery, C. (1978) True bilingualism and second language learning. In D. Gerver and H. Sinaiko (Eds.), Language Interpretation and Communication. New York: Plenum Press.
- Torgerson, W. (1958). Theory and methods of scaling. New York: Wiley.
- Tosi, A. (1979) Mother tongue teaching for the children of migrants. Language and Linguistics Abstracts, 12, 213-231.
- Tosi, A. (1984) Immigration and Bilingual Education.

- Totterman, N. J. (1979) Language Switching: A Comparison of Bilingual and Trilingual Speakers
Unpublished Masters thesis. Institute of Education,
University of London.
- Toulmin, S. (1971) The Concept of Stages in Psychological Development. In Cognitive Development and Epistemology.
New York: Academic Press
- Triandis, H.C. (1972) Analysis of Subjective Culture. New York:
Wiley.
- Triandis, H.C. (Ed.) (1980) Handbook of Cross-Cultural Psychology. Volume 1. Boston: Allyn and Bacon.
- Tumner, W.E., Pratt, C. and Herriman, M., Eds. (1984)
Metalinguistic Awareness. New York: Springer Verlag.
- United Nations Educational, Scientific and Cultural Organization
(1972). Resolution 1.141(c). In Records of General
Conference, Seventeenth Session, Paris, 1972, Volume One:
Resolutions and recommendations.
- Vaid, J., and Lambert, W. E. (1979) Differential cerebral
involvement in the cognitive functioning of bilinguals.
Brain and Language. 8(1), 92-110.
- von Nieuwenhuijze, C.A.O. (1962) Society as Process .
Merton.
- von Nieuwenhuijze, C.A.O. (1980) Middle East Development
Problems in the Light of Contacts between the Middle East
and the West. Brussels: European Cooperation Fund.
- Vernon, P.E. (1969) Intelligence and Cultural Environment.
London: Methuen.
- Versey, J. (1974) A longitudinal study of some aspects of
cognitive development in primary school children.
Unpublished Ph.D. dissertation, University of London.
- Versey, J. (1978) Scalogram analysis and cognitive developments
research: evidence from a longitudinal study.
British Journal of Educational Psychology 48, 71-8
- Versey, J. (1980) Longitudinal Studies and Piaget's Theory of
Cognitive Development in Modgil, Sohan and Modgil, Celia (Eds.)
Toward a Theory of Psychological Development Ch. 15
Windsor: NFER

- Volterra, V., and Taeschner, R. (1978) The acquisition and development of language by bilingual children. Journal of Child Language, 5, 311-326.
- Vuyk, R. (1981) Overview and Critique of Piaget's Genetic Epistemology, 1965-1980. Two Volumes. New York: Academic Press.
- Vygotsky, L.S. (1962) Thought and Language. Haufman, E. and Vakas, G. (Ed. and Trans.), New York: Wiley, and Cambridge, Mass: MIT Press.
- Wagner, D. A. (19) Cognitive perspectives on bilingualism in children. International Review of Applied Psychology, 29, 31-41.
- Wald, B. (1974) Bilingualism. In B. Siegel, A. Beals, and S. Tyler (Eds.), Annual Review of Anthropology, 3, 301-321.
- Weiner, S.L. (1974) On the Development of More or Less. Journal of Experimental Child Psychology, 17, 271-287.
- Weinreich, V. (1954/1968) Languages in Contact: Findings and Problems. The Hague: Mouton.
- Wheldall, K. and Poborca, B. (1980) Conservation without conversation: An Alternative non-verbal paradigm for assessing conservation of liquid quantity. British Journal of Psychology, 71, 117-134.
- White, B. L., Castle, R. and Held, R. (1964) Observations on the development of visually directed teaching methods, Child Development, 35, 349ff.
- White, R. (1959) Motivation reconsidered: the concept of competence, Psychological Review, 1959, 66, 297-333.
- Whorf, B. (1940) Technology Review, 44, 229-248.
- Whorf, B. (1956). Language, thought and reality. Cambridge, Massachusetts: M.I.T. Press.
- Wright, B. D. (1979) Solving Measurement problems with the Rasch model. Journal of Educational Measurement 14, 97-116.
- Yarrow, I. (1964) Separation from parents during early childhood, In Hoffman, L. and Hoffman, N. (ed), Review of Child Development Research. Vol. 1, New York: Russell Sage Foundation.
- Younniss, J. and Furth, H.G. (1965) The influence of transitivity on learning in hearing and deaf children. Child Development, 36, 533-538.

- Vihman, M. (1980) The Acquisition of Morphology by a Bilingual Child: a Whole-Word Approach. Paper presented at the Fifth Annual Conference on Language Development, Boston University.
- Vihman, M. (1980) Formulas in first and second language acquisition. Papers and Reports on Child Language Development, 18, 75-92(a). (Reprinted in L. Obler and L. Menn (Eds.), Exceptional Language and Linguistics. New York: Academic Press.)
- Vihman, M.M. and McLaughlin, B. (1982) Bilingualism and second language acquisition in preschool children. Progress in Cognitive Development Research. New York: Springer-Verlag.
- Younniss, J. and Furth, H.G. (1966) Prediction of causal events as a function of transitivity and perceptual congruency in hearing and deaf children. Child Development, 37, 73-81.
- Za'rour, G. (1971). Conservation of number and liquid by Lebanese school-children in Beirut. Journal of Cross-Cultural Psychology, 2, 165-172.
- Za'rour, G. (1972) The conservation of weight across different materials by Lebanese school children in Beirut. Science Education, 1972, 55, 387-394.
- Cohen, J. & Cohen, P. (1975) Applied multiple regression/correlation analysis for the behavioral sciences. Hillsdale, New Jersey, Erlbaum, New York.
- Nunnally, J. (1967) Psychometric Theory New York, McGraw-Hill

APPENDIX A
Supplementary Tables

APPENDIX TABLE A-1 Scale Points for Multidimensional Scaling Solutions in Two Dimensions (D1 and D2) for Each Conservation and Classification Task (Computed for Total Sample and Each Subsample)

TASK (a)	ALL		Mountain		Transitional		Segregated 0-2		Segregated 4+		Integrated		German	
	D1	D2	D1	D2	D1	D2	D1	D2	D1	D2	D1	D2	D1	D2
M2	0.877	0.959	-0.841	-0.910	(b)	(b)	0.646	0.554	(c)	(c)	(b)	(b)	0.179	1.133
M3	0.962	0.207	-1.164	-0.341	0.081	1.161	1.044	0.372	0.601	0.968	0.334	1.065	0.758	0.548
M4	0.839	-0.556	-0.977	0.656	-0.550	1.152	0.323	-0.740	0.045	0.018	0.637	-1.051	1.033	-0.994
M5	0.865	-0.351	-0.562	0.232	-1.055	0.779	0.837	-0.128	0.777	-0.952	0.725	0.338	0.662	0.279
M6	0.773	-0.371	-0.499	0.373	-1.140	-0.132	0.761	-0.658	1.254	-0.015	0.585	0.402	0.758	-0.081
M7	0.863	-0.222	-0.717	0.301	-0.494	-0.936	1.084	-0.456	1.127	-0.399	0.074	0.683	0.513	-0.256
M8	0.690	-0.230	-0.840	0.065	-0.681	-0.415	0.043	-0.369	1.051	0.406	0.539	0.841	1.068	-0.106
M9	0.766	-0.265	-0.966	0.410	-0.173	-1.296	0.702	-0.408	0.551	-0.393	-0.169	0.697	0.692	0.130
DQ	-1.161	0.021	1.061	-0.362	0.294	-0.615	-0.500	0.703	0.068	-0.697	-0.956	-0.302	-0.957	-0.043
Wt	-1.281	0.172	1.236	-0.071	-0.474	0.276	-0.913	0.280	-0.344	-0.777	-0.559	-0.361	-1.700	-0.423
DQ	-1.072	-0.539	0.539	0.526	0.838	0.016	-0.012	0.603	-1.000	-0.698	-1.177	-0.141	-0.088	-1.336
N1-1	-0.996	-1.096	0.971	0.980	1.430	-0.074	-0.810	1.020	-1.368	-0.009	-0.984	0.156	-0.563	-0.917
N:tc	-0.540	0.418	0.701	0.113	0.538	-0.011	-1.259	-0.243	-0.679	-0.529	0.869	-0.787	-0.119	0.465
DT	-0.594	-0.575	0.952	0.650	-0.060	-0.217	0.424	1.364	0.023	0.617	-0.737	-0.841	-0.536	-0.133
Liq1	-0.366	0.126	0.547	-0.510	0.130	0.316	0.038	0.177	-0.888	0.049	-0.032	-0.527	-0.252	-0.069
Liq2	-0.318	0.818	0.170	-1.248	0.972	0.874	-0.968	-0.665	-0.802	0.757	-0.074	-0.776	-0.311	0.011
Liq3	-0.617	1.163	0.500	-0.682	0.970	-0.508	-0.804	-1.154	-0.426	0.521	-0.605	0.772	-0.937	0.698
Ser	0.248	0.340	-0.111	-0.402	-0.425	-0.370	-0.635	-0.060	-0.001	1.133	1.530	-0.369	-0.369	1.094

Note. Points are results of multidimensional scaling analysis using Kendall rank order correlation (τ) between performance on each task as the index of task similarity. The distance measure used was 2.0 minus τ . Thus two items with a zero correlation would have a distance of 2.0, and two items that were perfectly correlated would have a distance of 1.0; in cases where the correlation was found to be negative, the distance would be less than 1.0.

It should be noted that these numerical values are those produced by the scaling program. In preparing the figures shown in Chapter 7, the plots were rotated (by hand) to produce rough similarity in their orientations. (The multidimensional scaling procedure produces configurations that may be freely rotated, since the inter-point distances are not affected by rotation. E.g., the distance from London to Birmingham is identical whether you hold a map right side up or upside down.)

(a) Tasks were: M2 to M9: Multiple Classification Matrices 2 to 9; Wt: Conservation of Weight; DQ: Conservation of Discontinuous Quantity; N1-1: Conservation of Number (one to one correspondence); N:tc: Conservation of Number (Tower and Cross problem); DT: Conservation of Distance and Time; Liq1: Conservation of Liquid 2; Conservation of Liquid 3 (Sum and Division Problem); Ser: Seriation

(b) Task not included in analysis because all children in sample gave correct response.

(c) Task omitted from analysis by accident.

APPENDIX TABLE A-2 Spearman Rank Order Correlations between Nonmetric Multidimensional Scaling (2-dimensional solution) of Task Difficulty for all Conservation and Classification Tasks (for all samples combined and for each subsample)

SAMPLE (& Dimension)	ALL-1	ALL-2	MV-1	MV-2	TV-2	TV-2	SD-1	SD-2	S4+:1	S4+:2	INT-1	INT-2	Germ-1	Germ-2
ALL (1)	1.0000													
ALL (2)	.0382	1.0000												
Mount. VILL.(1)	.8968	.0485	1.0000											
Mount. VILL.(2)	.0114	.9071	.0031	1.0000										
Trans. VILL.(1)	.5711	.2819	.4926	.2255	1.0000									
Trans. VILL.(2)	.1765	.0172	.0980	.0515	.0466	1.0000								
Seg. 0-2 Yr.(1)	.7709	.3148	.6780	.2549	.6348	.0784	1.0000							
Seg. 0-2 Yr.(2)	.3643	.2508	.4510	.1434	.3088	.0931	.0795	1.0000						
Seg. 4+ Yr.(1)	.6642	.1324	.6029	.1054	.8162	.2770	.7623	.3431	1.0000					
Seg. 4+ Yr.(2)	.2255	.2794	.2941	.3333	.1863	.0784	.0196	.1127	.0686	1.0000				
Integ. (1)	.6691	.2549	.5319	.1520	.5907	.2255	.2059	.4657	.4436	.1593	1.0000			
Integ. (2)	.3505	.0539	.4608	.0515	.1691	.3603	.4730	.1740	.4853	.0319	.0809	1.0000		
German (1)	.8064	.2633	.8363	.2695	.6021	.2244	.6660	.3944	.5739	.0025	.5714	.2980	1.0000	
German (2)	.3457	.7503	.2755	.6904	.0882	.1005	.0320	.1434	.1348	.3701	.4412	.2377	.0165	1.0000

APPENDIX TABLE A-3 Pearson Product Moment Correlations between Nonmetric Multidimensional Scaling (2-dimensional solution) of Task Difficulty for all Conservation and Classification Tasks (for all samples combined and for each subsample)

SAMPLE & Dimension	ALL-1	ALL-2	MV-1	MV-2	TV-2	TV-2	SD-1	SD-2	S4+:1	S4+:2	INT-1	INT-2	Germ-1	Germ-2
ALL (1)	1.0000													
ALL (2)	.0002	1.0000												
Mount. Vill.(1)	.9639	.0141	1.0000											
Mount. Vill.(2)	.0183	.9061	.0000	1.0000										
Trans. Vill.(1)	.6621	.2136	.5521	.2024	1.0000									
Trans. Vill.(2)	.0980	.0506	.1150	.1353	.0001	1.0000								
Seg. 0-2 Yr.(1)	.7560	.3055	.7240	.2495	.5921	.0046	1.0000							
Seg. 0-2 Yr.(2)	.4289	.3588	.4483	.2091	.2732	.0103	.0001	1.0000						
Seg. 4+ Yr.(1)	.7785	.1219	.7110	.1260	.8299	.2059	.7274	.3486	1.0000					
Seg. 4+ Yr.(2)	.2178	.3338	.2176	.3780	.1284	.1645	.0438	.0910	.0000	1.0000				
Integ. (1)	.6907	.1902	.5913	.1195	.5888	.2161	.1660	.5005	.4546	.2876	1.0000			
Integ. (2)	.4555	.0002	.5143	.0073	.1766	.3553	.4769	.2416	.5405	.0358	.0000	1.0000		
German (1)	.8747	.2863	.8858	.2768	.5189	.1512	.7134	.3606	.6283	.0617	.5420	.3723	1.0000	
German (2)	.3470	.7281	.2551	.6584	.1578	.1386	.0253	.1778	.2820	.4431	.5453	.2422	.0001	1.0000

APPENDIX B

Language and the Latent Structure of Cognitive Development
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Language and the latent structure of cognitive development ⁽¹⁾

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A cross-cultural method was used to explore theoretical implications of the reported association between mastery of the comparative forms in language and development of competency in dealing with difference and equality relations (such as those of Piaget's conservation problems). Since Turkish allows comparisons to be made without the use of a morphologically distinct form (equivalent to: John is to Mary tall), it was selected for contrastive study along with English and Greek which share a similar system for comparisons. One hundred and ten English, Turkish-Cypriot and Greek-Cypriot children (age 4-11) attending school in London were tested on a variety of language, conservation, and multiple classification problems. The results of this testing indicated that language competency does play a significant role during the course of cognitive development, and that variations in language structure can engender parallel variations in the structure of development. Statistical analyses suggested the following specific conclusions: (1) the concrete operations stage is not functionally unified; (2) the structure of development during this stage is multidimensional; and (3) constancy across cultures in the ordering of development during this stage arises, in part, from similarities between their languages in the representation of attribute and difference relations.

Piaget (1966) inaugurated this journal with a treatise on the necessity and significance of comparative research in which he drew attention to the potential cultural and linguistic relativity of his own findings:

En un mot la psychologie que nous élaborons en nos milieux, caractérisés par une certaine culture, une certaine langue, etc. demeure essentiellement conjecturale tant qu'on n'a pas fourni le matériel comparatif nécessaire à titre de contrôle (p. 12).

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Such concern for cross-cultural comparisons is appropriate to all branches of psychology, and it is *crucial* for any theory which aspires to elaborate "l'épistémologie génétique". The present research was undertaken to provide such comparative material by exploiting an unusual opportunity for a quasi-experimental study of the influence of linguistic factors upon the structure of cognitive development in comparable groups of Turkish, Greek, and English speaking children.

Empirical evidence in this area is relatively meager. Although past cross-cultural research (reviewed by Dasen, 1972) has considered the possibility that children in other cultures may differ from the youth of Geneva in the structure or rate of their cognitive development, few studies have identified any factors which could account for the differences which have been found. As Dasen concluded in his summary of this research, the data provided by almost all of these studies is *descriptive*; a great deal of further research is needed to link variations in development to specific cultural factors. Furthermore, although theories of the functional interrelation of language and thought have a long history (e. g., Whorf, Sapir, Vygotsky, Luria), cross-cultural researchers have paid little attention to the manner in which structural differences in languages might account for variations in the development of cognitive skills.

An exception to the general case is the work of Sinclair de Zwart (1967) who has presented evidence that children who conserve use different linguistic forms than children who do not conserve. Adapting the notions of "scalar" and "vector" words from the linguist Bull (1963), Sinclair de Zwart observed that most French and English children designated as "conservers" made use of vectors, (e. g., *more* and *less*), while "non-conservers" relied on ordinary scalars (e. g., *much* and *little*) which could be coordinated to express comparisons, for example,

This is bigger. (*using a vector*).

This is big and that is small. (*using coordinated scalars*).

These findings, which have been replicated in a longitudinal study by Versey (1974), have interesting implications for the study of cognitive development in cultures whose languages do not have linguistic structures parallel to the English and French comparative forms.

Piaget (1966) in noting the significance of such research, has drawn attention to the need to extend these studies outside of the European language families,

On voit alors d'emblée le très grand intérêt qu'il y aurait à multiplier des expériences de cette sorte en fonction de langues diverses. Sinclair a trouvé les mêmes résultats en français et en anglais. Mais il reste à recourir à des langues bien différentes. *En turc, par exemple, il n'existe qu'un seul vecteur, qui correspond à notre terme « encore »; pour dire « plus » on dira « encore beaucoup » et pour dire « moins », « encore peu ».* (p. 12, italics added)

In noting this divergence in linguistic structure between Turkish and French modes of comparison, Piaget suggests the unique importance of work with Turkish populations. Dasen's (1972) bibliography of cross-cultural Piagetian research includes no study carried out with a population speaking a Turkic language.

Since we will be reporting the first such study ⁽²⁾, it is important that we commence with a more precise statement of the relevant aspects of Turkish grammar.

Vectors and scalars in Turkish grammar—a restatement

Although Piaget was quite correct in his observation that the structure of the comparative in Turkish is very different from the French comparative, his explanation was somewhat incomplete and imprecise. First, although the translation of "daha" as "encore" is consistent with some, particularly Ottoman sources (e. g., Barbier de Meynard, 1881), it does leave much to be desired. Its translation might better and more simply be rendered as the vector sign ("plus" = "more") which is the first listed translation given in Delibasi's (1944) and Hony's (1967) dictionaries of contemporary Turkish.

Secondly, in contrasting the formation of vectors in Turkish and French ⁽³⁾, Piaget oversimplifies the Turkish case, and thereby fails to convey just how different the two structures are. Specifically, while the simple comparison expressed in English by,

English: This is more.

is correctly and uniquely rendered by use of the vector sign "daha" together with the adjective "çok" (much, many), i. e.,

Turkish: Bu daha çok.

Literal: This (is) more much.

the "daha" is not required when the object of the comparison is stated. In this case the scalar (adjective) may stand alone, for example,

English: This is more than that.

Turkish: Bu ondan çok. OR Bu ondan daha çok.

Literal: This (is) much than that. OR This (is) more much than that.

Thus, in the case of two explicitly stated objects, a Turkish-speaker may communicate their comparison by using a scalar adjective alone. The use of "daha" in such cases is optional ⁽⁴⁾ (cf., Nemeth, 1916, no. 53; Godel, 1945,

⁽²⁾ The only studies of which we are aware are the unpublished investigation of seriation by Professor Semin in Istanbul (cited in Piaget, 1952), the unpublished research of Professor Collier (personal communication), and the work of Professor Slobin (personal communication) and his colleagues on language acquisition.

⁽³⁾ Some differences do exist between English and French. Sinclair de Zwart draws attention to the two structures used to express the comparative in English: (1) the "-er" suffix, and (2) the adverb "more"; as well as the multiple uses of "plus" in French. Nonetheless, in a comparative study of English and French, she found similar patterns of development.

In this regard it is interesting to note that the Turkish parallel to the "-er" suffix of English ("-rak", "-rek") disappeared from common usage during the Ottoman period, although it survives today in a number of Anatolian usages (e. g., "yegrek" = "daha iyi": better); and in many other Turkic languages. See Menges (1968) and Nemeth (1916).

⁽⁴⁾ Lest the reader be misled, two points deserve clarification. (1) the simple comparative outlined above, is a grammatically acceptable form which is frequently employed. There is some tendency (which we cannot quantify at this point) for educated speakers to consider the simpler form (Bu ondan çok) incorrect or "peasant-like"; (2) the form "Bu daha çok" should *not* be understood as the English "This is much more" which would be expressed as "Bu çok daha çok."

p. 66; Lewis, 1967, pp. 54-55; Gencan, 1971, no. 382). This pattern is consistent for all adjectives; thus for "expensive" (pahali) we have:

- SIMPLE:** English: This is more expensive.
 Turkish: Bu daha pahali.
 Literal: This (is) more expensive.
- COORDINATED:** English: This is more expensive than that.
 Turkish: Bu ondan pahali. OR Bu ondan daha pahali.
 Literal: This (is) expensive than that. OR This (is) more expensive than that.

Table 1 summarises the structure of the comparative in Turkish and contrasts it to English. Readers will note that in English a morphologically distinct vector (more) is both the comparative for quantity (scalar = "much"), and it, or its analog (-er), *invariably* must appear in all comparisons of quality. However, in Turkish the scalar alone can suffice for comparisons, and it must appear even in the comparison of quantities. Thus, the linguistic divergences involved in the comparative study of Turkish and non-Turkish speaking populations are even greater than those set out by Piaget.

Overview of the research

The present study exploits a unique opportunity for the controlled investigation of the effect of linguistic factors upon cognitive development. This opportunity arises from the presence in London of a group of Cypriot immigrant children who come from equivalent social backgrounds⁽⁵⁾, but differ in their native languages: Greek or Turkish. Since Greek structures the comparative in a manner similar to English, these samples provide the possibility of a quasi-experimental study in which language structure could be considered an independent variable (*i. e.*, a treatment condition) and in which a monolingual English group is available for further comparative analysis. The present study of these populations was designed to facilitate:

- 1) an analysis of the latent structure of the skills tapped by conservation, seriation, and multiple classification tasks, in order to test the assumption that the structure of operational development is invariant across languages;
- 2) and secondly, an extension of Sinclair de Zwart's analysis to the Greek and Turkish cases.

Subjects

METHOD

A sample of children ($N = 110$; 47 percent male) was drawn from among the four to eleven year old pupils in two junior and two infants schools in North London. These schools contained approximately equal numbers of Turkish and Greek Cypriot children (10 to 15 percent of population), a larger number of working class English children, and smaller numbers of Indian, Pakistani, Italian, and African students.

⁽⁵⁾ Greek-speaking Cypriots in London have a social status which is roughly equivalent to the Turkish Cypriots; both groups are migrants who have been resident in Britain for equal periods of time and who share the same neighborhoods and schools.

TABLE 1

COMPARISON OF LINGUISTIC STRUCTURE OF COMPARISONS IN ENGLISH AND TURKISH

	Type of comparison	Structure in English	English example	Structure in Turkish	Turkish example
Q U A N T I T Y	Description —no comparison	Scalar adjective alone	This is much	Scalar adjective alone	Bu çok.
	Simple comparison (object absent)	Vector sign alone	This is more	Vector sign and scalar adjective	Bu daha çok.
	Coordinated comparison (object present)	Vector sign alone	This is more than that	Scalar adjective alone OR* Vector sign and scalar adjective	Bu ondan çok. OR* Bu ondan daha çok.
Q U A L I T Y	Description —no comparison	Scalar adjective alone	This is beautiful	Scalar adjective alone	Bu güzel.
	Simple Comparison (object absent)	Vector sign and scalar adjective	This is more beautiful	Vector sign and scalar adjective	Bu daha güzel.
	Coordinated comparison (object present)	Vector sign and scalar adjective	This is more beautiful than that	Scalar adjective alone OR* Vector sign and scalar adjective	Bu ondan güzel. OR* Bu ondan daha güzel.

Note : For simplicity, we omit from the table the class of English vector-adjectives (bigger, etc.). This aspect of the English comparative is not paralleled in the Romance languages, although a similar duality does occur in Greek. This divergence has been the subject of a study by Sinclair de Zwart, who concentrated her attention on the three uses of the vector sign "plus" in French (*i. e.*, as vector sign for qualities, as comparative of "beaucoup", and lastly to express time as in "je n'en ai plus").

*forms are interchangeable, and equally correct.

Samples of Greek ($N=40$) and Turkish ($N=37$) children were randomly drawn from the population of four to eleven year olds. Only children speaking fluent Greek(G) or Turkish(T) and who reported this to be the normal language in their homes were included in these samples. The English(E) sample was restricted to children aged six to eleven due to widespread absences in the infants schools at the end of the term. All children in the English sample came from monolingual homes.

To test the social similarity of these samples, the children were asked how many brothers and sisters they had, and what type of work their fathers did. Children in all language groups reported a median of two siblings, and their fathers' were mainly employed in skilled manual and lower grade non-manual occupations. The English fathers, however, did tend to work in slightly more skilled occupations. Coding these data into the seven-point Hall-Jones (1950) classification of occupations, we found a 0.7 unit difference between Cypriot and English fathers [mean level = 5.5(T), 5.2(G), 4.6(E)]. Standardised reading test scores were available for 64 children in the sample. These scores showed both the Turkish and Greek Cypriot samples to be lagging 13 months behind the national reading norms for Britain. This result is not unusual for bilingual children from working class homes. Scores for the English sample were, as expected, significantly higher than those of the immigrant sample, however these scores also were somewhat lower than the national average.

Measures of linguistic and cognitive development

Tests used in the present research included:

1. Language pretests.
2. Conservation of number, weight, continuous and discontinuous substance, and three tests of conservation of (liquid) quantity.
3. Seriation.
4. Multiple classification.

The *language pre-tests*, derived from Sinclair de Zwart (1967), were used to explore the children's use and understanding of scalar and vector concepts. These tests included the marble-doll, and sticks tests which elicit childrens description of inequalities, as well as the multiple groups and pencil tests for the provoked understanding of vector concepts. The *multiple classification tasks* employed the nine matrices described by Inhelder and Piaget (1964) which were administered in the manner of Almy (1970) with the modification that children were shown a display of alternatives and required to select one element to complete the matrix.

Seriation and conservation tasks were administered using the procedures of Versey (1974). The *seriation* task required the ordering of a set of sticks into a staircase as first described by Piaget (1952). The conservation of *substance* and *weight* tasks employed plasticene which was deformed into a "sausage" in the manner of Piaget and Inhelder (1941). *Number conservation* was assessed by having the child and tester construct "towers" with counters; each time the tester put down a counter the child did likewise. Subsequently, one tower was re-arranged into a cross and the child was asked if the two configurations had the same number of counters. Four tasks involving transformations of quantities were used in this research. Briefly, they were (1) *continuous quantity-liquid 1*: liquids in two identical jars are adjusted until the child judges them to be equal, and then one jar is emptied into a tall narrow jar and the child is asked if the quantities are still equal; (2) *discontinuous quantity*: same as "liquid 1" except that beads are substituted for water; (3) *continuous quantity-liquid 2*: child is required to indicate when water poured into a wide beaker is equal in amount to the water in a much narrower beaker; a child passes this task if he stops the pouring before the water-level in the wide jar reaches that of the narrow jar; (4) *sum and division of continuous quantity*: the amount of liquid in two identical jars is adjusted until the child indicates they are equal and then one jar is poured into four smaller jars. The child is then asked if the amount in the large beakers is the same as the total amount in the four little jars.

All conservation and classification tasks were scored for their initial judgement, explanation, and judgemental stability. Answers were classified as operational only if the correct judgement was given, if an operational explanation was made, and if the initial judgement was stable. Operational explanations included: identity, reversibility, reciprocity, state of operations, addition-subtraction, or equality for conservation tasks (see Versey, 1974); mention of one or more correct criteria (and no incorrect ones) for two-dimensional matrices; and mention of two or more correct criteria for three-dimensional matrices.

Testing procedure

All testing was done in the children's native language by the first author who speaks native Greek and Turkish, and fluent English. To familiarise herself with any idiosyncrasies in the Cypriot dialects spoken by the Turkish and Greek children, the author resided for three months in the residential district from which the sample was drawn. The major peculiarities which she noted were distinctive accents in both languages and the occasional interjection of English phrases into conversations that were otherwise exclusively Greek (or Turkish).

Testing was done individually at the children's schools, and was divided into two sessions of approximately 40 minutes each. All conservation and seriation tasks were given in a single session and the order of tasks within this session was randomized across subjects. Multiple classification tasks were given in a fixed order at a separate session. The order of presentation of the two testing sessions was balanced across the study.

Test reliabilities

Since appropriate multi-lingual testers were not available in London for test-retest reliability analyses, all testing sessions were tape recorded. Subsequently one third of the recordings were rescored by raters who were unaware of the purpose of the study. Raters' agreement with the authors' classification of explanations averaged 88 percent.

RESULTS

Performance on the conservation and multiple classification tasks

The most striking result revealed by an analysis of the groups' performance on the various tasks was the delineation of two relatively *independent* areas of operational development: conservation and multiple classification. This result was evident even in a rather crude comparison. Summing results across the seven conservation problems, we found that the English children gave operational solutions to significantly more ($t=2.07$, $df=68$, $p<.05$) of these problems than the Turkish children. The performance of the Greek children was midway between that of the Turkish and English groups. This result, in itself, should startle no one, although it is unique in that all of the children were of similar socioeconomic status and were tested in their native languages. The surprising result was obtained when we performed a similar analysis of the children's performance on the eight multiple classification matrices. Here we found an exact reversal of the previous pattern: the Turkish children solved significantly more classification problems than the English children ($t=2.05$, $df=68$, $p<.05$), and again the Greek children fell midway between the two extremes. Identical results were obtained when analyses of covariance were employed across the three groups, with the effects of age being held constant.

This reversal of performances is representative of the findings on each individual task. Table 2 presents a breakdown by age and language group of the children's performance, and the results of covariance analyses for each task (controlling for age). An examination of Table 2 confirms the results of the gross analysis. With only one exception, we find that all significant differences on conservation tasks show the Turkish children to perform most poorly, and on the multiple classification matrices, for them to perform most competently. We also note that the poor performance of the Turkish children on the conservation tasks cannot be attributed to a deficiency in their ability to seriate since all the Turkish children aged six or above demonstrated competency in this area.

These results are disquieting since they preclude any simplistic notion of a general deficit in operational development, and thus they bring into question the unity of the concrete operations stage itself. While the present study was being completed, Heron and Dowel (1974) encountered a similar phenomenon in their work with Serbo-Croatian immigrants in Australia. A series of analyses which parallel those of Heron and Dowel have been performed on the present data, and the results substantially support their conclusions. In particular, classifying as "operational" any child who succeeded at five of the problems in either set, it was found that *all* the Turkish children who were "operational" on the conservation tasks were also "operational" in the multiple classification tasks, whereas seven of the seventeen English children who were "conservers" did not succeed at the multiple classification tasks ($p < .05$ by Fisher exact test). Conversely, of the 24 Turkish children who were operational in the classification tasks, only 33 percent exhibited the appropriate range of conservation skills, while the comparable figure for the English was 72 percent ($p < .05$ by the Fisher exact test). Here again the Greek children fell midway between the extremes delimited by the Turkish and English cases; 52 percent of the Greek children who were "operational" on the classification tasks also evidenced operational thought on 5 or more conservation problems.

Since this evidence is congenial to the hypothesis that language structure may exert a determining influence upon the course of cognitive development, we have undertaken a closer analysis of the underlying structure of development.

Searching for developmental structure: a unidimensional approach

A basic aim for the present study was the elaboration of the latent structure of cognitive development during the concrete operations stage, so as to permit an examination of the influence of language. One approach to this question is to begin by assuming that the 16 Piagetian tasks may show an invariant ordering of "difficulty" which reflects a developmental sequence such as that in which all children learn to walk by first crawling. The Guttman scaling procedure (cf. Torgerson, 1958) provides a method for such analyses. By using this technique to obtain *independent* orderings of task difficulty for the Greek, Turkish, and English samples, we can test the hypothesis that the order of difficulty for the 16 tasks is constant across languages.

Performing this analysis we found substantial inconsistency across groups in the ordering of task difficulty, with the least consistency existing between the

TABLE 2

TASK PERFORMANCE (% PASSING) BY AGE AND LANGUAGE GROUP

Task	Age	LANGUAGE				COVARIANCE ANALYSIS ^a	
		Turkish (N=37)	Greek (N=40)	English (N=33)	Total (N=110)	sig. level	order
Conservation of quantity (discontinuous)	4-5	0 (5)	0 (3)	----	0 (8)	n.s.	----
	6-7	75 (8)	27 (11)	30 (10)	41 (29)		
	8-9	53 (13)	92 (13)	50 (14)	65 (40)		
	10-11	91 (11)	70 (13)	78 (9)	78 (33)		
Conservation of number	4-5	20	0	----	13	p<.02	G/E/T
	6-7	13	27	60	35		
	8-9	23	34	36	38		
	10-11	36	85	67	64		
Conservation of substance (plasticene)	4-5	0	0	----	0	p<.001	E/G/T
	6-7	13	0	60	24		
	8-9	23	7	71	35		
	10-11	55	77	67	67		
Conservation of weight (plasticene)	4-5	0	0	----	0	n.s.	----
	6-7	13	0	30	14		
	8-9	23	31	36	30		
	10-11	55	39	67	52		
Conservation of quantity (continuous/liquid 1)	4-5	20	0	----	13	p<.01	G/E/T
	6-7	13	46	30	35		
	8-9	31	77	37	90		
	10-11	64	92	89	82		
Conservation of quantity (continuous/liquid 2)	4-5	0	0	----	0	n.s.	----
	6-7	13	9	20	14		
	8-9	15	39	36	30		
	10-11	18	31	33	27		
Sum & division of continuous quantity	4-5	40	0	----	25	n.s.	----
	6-7	38	9*	30	24		
	8-9	69	85	36	63		
	10-11	100	100	67	91		
Seriation	4-5	0	0	----	0	n.s.	----
	6-7	100	55	80	76		
	8-9	100	93	79	90		
	10-11	100	100	90	97		
Matrix 2	4-5	60	100	----	75	p<.005	G/T/E
	6-7	100	100	80	75		
	8-9	92	100	71	88		
	10-11	100	100	89	97		
Matrix 3	4-5	40	67	----	50	p<.05	T/G/E
	6-7	38	46	30	38		
	8-9	92	77	50	73		
	10-11	100	77	78	85		
Matrix 4	4-5	40	0	----	25	n.s.	----
	6-7	50	64	40	52		
	8-9	85	62	50	65		
	10-11	91	77	89	85		
Matrix 5	4-5	0	67	----	25	n.s.	----
	6-7	13	18	20	17		
	8-9	34	54	57	55		
	10-11	73	62	78	70		
Matrix 6	4-5	20	33	----	25	p<.05	T/G/E
	6-7	25	0	10	10		
	8-9	46	39	21	35		
	10-11	73	34	33	55		
Matrix 7	4-5	20	67	----	38	n.s.	----
	6-7	38	27	20	28		
	8-9	69	46	43	53		
	10-11	82	77	67	76		
Matrix 8	4-5	0	67	----	25	p<.15	T/G/E
	6-7	50	36	30	38		
	8-9	46	31	29	35		
	10-11	91	85	56	79		
Matrix 9	4-5	20	0	----	13	p<.05	T/G/E
	6-7	30	46	20	38		
	8-9	54	62	29	48		
	10-11	91	51	50	73		

Note: Sample sizes for the table are given in parentheses with the entries for the first task; because of extremely small sample sizes, results for the 4-5 year olds should be interpreted with extreme caution.

* Covariance analysis tests the significance of differences between the three language groups, after first adjusting for the effects of age on performance. For all tests, the degrees of freedom were 2/106.

rankings for the Turkish and English groups ($\tau = +0.3$, ns). Since the Turkish and English groups differ in *both* their (1) immigrant status and attendant bilingualism, and (2) the manner in which their native languages structure comparisons, this result may be interpreted as evidence of the influence of *either*, or both, factors. This problem may be resolved by reference to the orderings obtained for the Greek and English groups, who differ in migrant status but share a common structure in their native languages for the expression of comparisons. Since the similarity ($\tau = +0.6$, $p < .001$) between task rankings for these two groups (who differ on only one dimension) is almost double that between the Turkish and English samples (who differ on both dimensions) we have a basis for concluding that additional variation in language structure diminishes consistency in the sequencing of cognitive development (⁶).

While these findings derive from "difficulty orderings" which are maximally faithful to the patterns extant in the data, it is appropriate to ask just how invariant these orders were. The coefficients of reproducibility for the three scales ranged from +0.85 to +0.89, and they indicate that the orderings admit to considerable exception. A conventional minimum value for acceptable scale reproductibility is +0.90 (Torgerson, 1958).

A consideration of the nature of the tasks used in this study provides a basis for interpreting this result. The analytic method we have used—Guttman scale analysis—assumes that each task taps the same underlying trait, and that performance varies only with the level of the trait which is required to succeed on a given task. This assumption of a single dimension of difficulty is untenable, as our results demonstrate. Each of the various Piagetian problems differs not only in the sophistication of the logical operations required for solution, but it also varies in cultural familiarity, openness to perceptual distortion, relative demands upon memory, etc. Thus, the representation of problem difficulty requires *at least* two dimensions: one summarising the complexity of the logical operations required for solution, and a second summarising the extraneous situational complexities of the problem (⁷).

Searching for developmental structure: a multidimensional approach

Since unidimensional analyses confound the operational difficulty of the Piagetian tasks with extraneous contextual factors, we have employed non-metric multidimensional scaling techniques (see Kruskal, 1964) to provide a more appropriate model of the developmental structure of the concrete operations stage. Using this technique we can position the 16 Piagetian tasks

(⁶) The correlation between task orderings for the Turkish and Greek groups—who differ only in language structure—is also greater than that between the Turkish and English groups ($\tau = +0.7$, $p < .001$), and thus we might conclude that migrant status (and its attendant bilingualism) have an influence which may be slightly more potent than language structure.

(⁷) Multi-dimensionality in task difficulty is not a problem unique to the present inquiry. Such considerations inevitably arise when one attempts to conclude from a comparison of failure rates for two tasks, that one involves more complex cognitive processes. It always may be the case that a difference in the failure rates arises not from the complexity of the cognitive processes required, but rather from extraneous characteristics of the context of the problem. Examples of such difficulties can be found in the controversy between Bever *et al.* (1968) and Beilin (1968), and in the critical writings of Bryant (1974).

in (m -dimensional) space in such a way that the *distances* between the tasks correspond (monotonically) to their *dissimilarities*. Estimates of task-dissimilarity, in turn, can be derived from the empirically observed associations (Yule's Q) between performance on each pair of tasks; for dichotomous data such as these, Yule's Q is identical to the "monotonicity coefficient" recommended by Bentler (1971).

Applying these procedures, we computed solutions for up to four dimensions, and it was found that the concrete operations problems were best represented by two axes corresponding to the *operational* and *situational* complexity of the tasks. Thus, we found a substantial reduction in stress (*i. e.*, badness-of-fit) when we moved from a one- to a two-dimensional solution: +0.36 to +0.13, while the addition of further dimensions did not substantially reduce the stress value (+0.10 and +0.07 in 3- and 4-dimensions). These results using the total sample were replicated when the tasks were rescaled separately for each language group. For all groups, the two-dimensional solutions were statistically reliable ($p < .05$, using the standards of Klahr, 1969).

Figure 1 displays the structure of the solutions obtained for the total sample, and for each group taken separately. Examining the results for the complete sample (top left panel) we find the tasks to be spatially arranged in an intuitively reasonable pattern; along the *operational* complexity dimension (O) the tasks form two separate clusters, one consisting of the multiple classification problems and the other of the conservation and seriation problems (to aid interpretation each cluster has been delimited in the figure). Furthermore we see that the seriation and liquid summation problems are themselves somewhat isolated from the clusters of classification and conservation problems. Along the *situational* complexity dimension (S) the most extreme point represents the second liquid conservation problem in which the children were required to stop pouring water in time to produce equal quantities in two jars of different diameter. Since almost 50 percent of the children failed this task because they did not stop pouring in time—although they subsequently realised their error—the scale position of this task is interpretively meaningful. Similarly, the low "situational" complexity of the conservation of discontinuous quantity problem (DQ) reflects the greater availability of perceptual cues in this context; thus this representation accounts for the fact that young children who conserve quantity when the problem involves *discrete* units (*e. g.*, beads), often fail to conserve when the same problem is repeated with a *continuous* substance (*e. g.*, water) ⁽⁸⁾.

(⁸) To test these interpretations we have used the "complexity dimension" scores for each of the 16 tasks to predict the passing rates shown in Table 2. Regressing the passing rates for the total sample upon the task complexity scores and the ages of the children, we were able to predict 59 percent of the variation in passing rates shown in this table. The standardised partial regression coefficients for the operational complexity ($b^* = +0.18$) and situational complexity ($b^* = +0.36$) dimensions indicated that the orientation of the dimensions was correct, *i. e.*, increasing complexity was reliably associated ($p < .05$) with decreasing rates of passing. Moreover, by referring to the coefficient for age ($b^* = +0.65$), we find that individually these dimensions of task difficulty were one-quarter to one-half as effective as the child's age in accounting for the variations in passing rates summarised in Table 2.

Given the statistical and theoretical meaningfulness of this two dimensional representation of the concrete operations stage, we are in a position to assess the consistency of this structure across language groups. The three remaining panels of Figure 1 provide the needed information. Here we note that the solutions obtained for the English and Greek samples are similar to each other

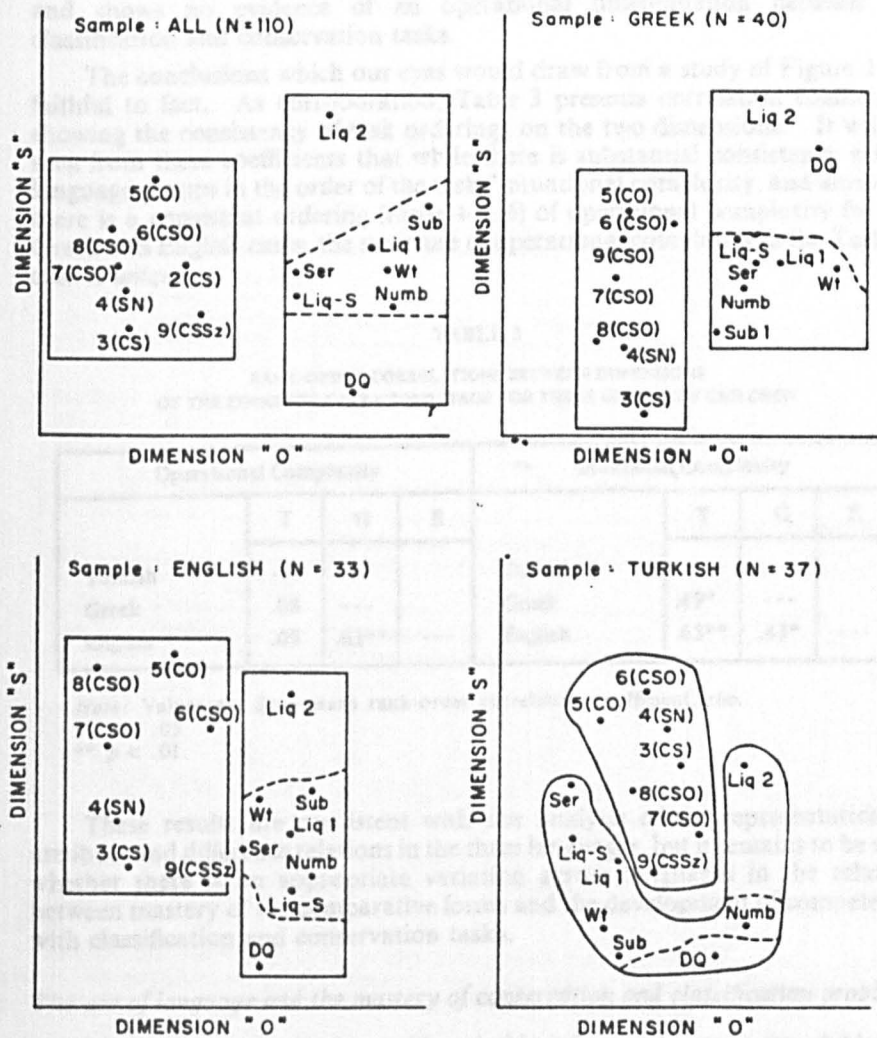


FIG. 1. — Two dimensional solutions from non-metric multidimensional scaling analysis. Points 2 through 9 represent the multiple classification tasks; classification criteria are given in parentheses (C = colour, S = shape, Sz = size, N = number, O = orientation). The other points represent the conservation and seriation problems (Liq = liquid, DQ = discontinuous quantity, Wt = weight, Sub = substance, Numb = number, Ser = seriation).

and replicate the overall pattern, although there is some variation particularly in the situational complexity dimension. Nonetheless, both structures show a characteristic and theoretically appropriate division of operational complexity into two non-intersecting sets—the classification and the conservation tasks. The structure obtained for the Turkish case, however, is quite different, and shows no evidence of an operational differentiation between the classification and conservation tasks.

The conclusions which our eyes would draw from a study of Figure 1 are faithful to fact. As corroboration, Table 3 presents correlation coefficients showing the consistency of task orderings on the two dimensions. It will be seen from these coefficients that while there is substantial consistency across language groups in the order of the tasks' situational complexity, and although there is a consistent ordering ($\rho = +0.6$) of operational complexity for the Greek and English cases, the structure of operational complexity in the Turkish case is *unique*.

TABLE 3
RANK-ORDER CORRELATIONS BETWEEN DIMENSIONS
OF THE CONCRETE OPERATIONS STAGE FOR THREE GROUPS OF CHILDREN

Operational Complexity				Situational Complexity			
	T	G	E		T	G	E
Turkish	---			Turkish	---		
Greek	.08	---		Greek	.49*	---	
English	.09	.62**	---	English	.63**	.43*	---

Note: Values are Spearman's rank-order correlation coefficient, ρ .

* $p < .05$.

** $p < .01$.

These results are consistent with our analysis of the representation of attribute and difference relations in the three languages, but it remains to be seen whether there is an appropriate variation across languages in the relation between mastery of the comparative forms and the development of competency with classification and conservation tasks.

The use of language and the mastery of conservation and classification problems

Two language pre-tests provide suitable information upon the children's use of language. In the first pre-test the children were *provoked* to respond in difference terms by asking that they indicate which of two pencils was longer, thicker, etc., while in the second pre-test (*spontaneous* usage) the children were asked simply to describe the differences between two blocks of wood. In both cases, children's responses were coded for their use of scalar, vector, bi-partite

and quadripartite forms. Given the focus of our present interest, we will concentrate our analysis upon the use of vectors (*e. g.*, "more") in their speech.

Overall it was found that, regardless of the language spoken, older children were more likely to use the vector forms [covariate $F(1,106) = 10.7$ (provoked), and 16.4 (spontaneous), $ps < .005$]. The frequency with which vector forms

TABLE 4
RELATIONSHIP BETWEEN USE OF VECTOR FORMS ON LANGUAGE PRETESTS
AND PERFORMANCE ON THE CONSERVATION AND MULTIPLE CLASSIFICATION TASKS

4a. Conservation								
GREEK				TURKISH				
Test	Provoked Use		Spontaneous Use	Provoked Use		Spontaneous Use		
	S	V	S	V	S	V	S	V
Pre-Op	5	3	5	3	8	1	6	3
Int	8	11	7	12	13	7	10	10
Op	1	12	1	12	5	3	2	6
$\chi^2 = 6.49, p < .05$			$\chi^2 = 6.45, p < .05$		$\chi^2 = 1.99, ns$		$\chi^2 = 2.97, ns$	
4b : Multiple Classification								
GREEK				TURKISH				
Test	Provoked Use		Spontaneous Use	Provoked Use		Spontaneous Use		
	S	V	S	V	S	V	S	V
Pre-Op	5	2	4	3	6	0	6	0
Int	2	8	3	7	6	1	6	1
Op	7	16	6	17	14	10	6	18
$\chi^2 = 5.31, p < .05$			$\chi^2 = 1.95, ns$		$\chi^2 = 4.97, p < .05$		$\chi^2 = 15.6, p < .001$	

Note: Children were classified as vector users (V) if they used this form one or more times during the pre-test. Operational performance for both sets of tasks was defined as: Pre-operational, 0 or 1 problem solved; Intermediate, 2 to 4 problems solved; Operational, 5 or more problems correctly solved.

As a rule, chi-square results for tables with small cell sizes should be treated cautiously. In the present case, collapsing categories of operational performance and applying the Fisher exact test produces a similar pattern of results although the overall significance levels decline slightly.

were employed also varied significantly across languages and this variation replicated the pattern of group differences in performance on the conservation tasks. While 91 percent of the English children spontaneously used vectors, only 67 percent of the Greeks and 51 percent of the Turkish children used such forms [controlling age, $F(2,106) = 8.68, p < .001$]. Furthermore, Turkish and

Greek children showed an overwhelming preference for encoding the vector sign as a separate word ($\pi\iota\omicron$ or *daha*) rather than using the Greek forms in which the vector sign is a suffix ($-\tau\epsilon\omicron\omicron$)^(*), or using the comparison by scalars (*e. g.*, *bu ondan çok*) available in Turkish. Use of the latter forms did not exceed 10 percent in either language.

The gross relationship between use of the vector forms in Greek and Turkish and performance on the conservation and classification tasks are shown in Table 4. From these tabulations we see that the use of the vector forms in Greek was reliably related to performance on the conservation tasks, but there was no reliable association in Turkish. For the multiple classification tasks the reverse holds true; use of the vector form was reliably related to classification performance in the Turkish sample.

TABLE 5

REGRESSION ANALYSIS OF "EFFECTS" ATTRIBUTABLE TO AGE AND MASTERY OF THE LINGUISTIC STRUCTURE OF THE COMPARATIVE UPON THE DEVELOPMENT OF CONSERVATION AND MULTIPLE CLASSIFICATION SKILLS

	REGRESSION COEFFICIENTS		
	Effect of age	"Effect" of language	Variance explained
CONSERVATION			
Turkish Sample	+ .61	(+.04)	.39 ^a
Greek & English Samples	+ .61	+ .18	.47 ^b
MULTIPLE CLASSIFICATION			
Turkish Sample	+ .52	+ .40	.63 ^c
Greek & English Samples	+ .39	(+.08)	.18 ^d

Note: "Effect coefficients" are standardized partial regression coefficients; analysis of the unstandardised coefficients produces similar results. Coefficients in parentheses are not reliably greater than zero (*i. e.*, $p < .05$, one-tail). Language mastery is a dichotomous variable coded "1" if the child used a vector form in either pretest (coded zero otherwise).

^a $F(2,34) = 11.07$, $p < .0005$.

^b $F(2,70) = 24.6$, $p < .0005$.

^c $F(2,34) = 28.14$, $p < .0005$.

^d $F(2,70) = 6.11$, $p < .005$.

(*) For commonly used adjectives, Greek comparatives may be formed by *either* preceding the adjective by $\pi\iota\omicron$ or appending the suffix $-\tau\epsilon\omicron\omicron$. The two forms are equally correct. The present finding suggests a possible explanation for Kelley *et al.*'s (1973) observation that many bilingual children in their study could conserve in English but *not* in their native Greek. Their testing procedures phrased all of the conservation questions in the less common $-\tau\epsilon\omicron\omicron$ suffix form.

Although Table 4 replicates the analysis of Sinclair de Zwart, it does not take into consideration the most important developmental variable—age. For this reason it may be argued that Table 4 overstates the relationship between language and cognitive development. Since a tabular analysis of these data, controlling for age, would produce many empty cells, we have employed a regression approach to further study this relationship. Multiple regression permits us to estimate the contribution of language mastery to performance while controlling for the spurious association arising from the effect of maturation on *both* language acquisition and operational development.

Table 5 presents the results of a regression analysis in which the dependent variable was the number of classification (or conservation) problems which were correctly solved. To simplify presentation we have combined the English and Greek samples since the nature of the comparative and the multidimensional structure of development for these groups were similar.

The coefficients shown in Table 5 exhibit a consistent and reliable developmental trend. For all language groups, the older children solved more conservation and more classification problems than younger children; the average rate of this development was approximately two additional solutions for each three years of age. Examining the coefficients for the independent "effect" arising from the use of the vector forms we find an identical trend to that shown previously. The mastery of the vector forms has a reliable independent "effect" upon performance on the conservation tasks for the Greek and English children but *not for the Turks*, while for the classification tasks the reverse again holds true. By comparison to the coefficients for age, we find that these two language "effects" were weaker than the effect of maturation.

DISCUSSION

These results suggest a number of important conclusions about the nature of cognitive development and the role of language during the concrete operations stage. Since our analyses have been undertaken in some detail and have yielded consistent results, the main conclusions require little embellishment. From the data it appears warranted to conclude that,

- 1) The concrete operations stage is *not functionally unified*, but rather it consists of two relatively independent sets of cognitive competencies whose order of development can vary across languages and cultures.
- 2) The latent structure of cognitive development during the concrete operations stage is *multi-dimensional*. Performance on any task reflects both the operational sophistication of the child and also the child's developing abilities to deal successfully with the other situational demands of the task (*e. g.*, requirements of memory, perception, motor coordination, etc.).
- 3) The structure of development during the concrete operations stage is *not constant across languages*. Rather, constancy in the ordering of operational development seems to arise from a common order embedded in the linguistic

structure of the children's native languages. Languages (*e. g.*, English and Greek) that code attribute and difference relationships in separate linguistic forms (scalars and vectors) show a similar division of operational development into classification and conservation skills. In such languages, mastery of the vector form is predictive of performance on the conservation problems. However, in a language (*e. g.*, Turkish) which allows an identical form to be used in both classification and comparison, we find an overlapping in the development of conservation and classification skills, and no association between mastery of the vector form and performance on the conservation problems.

To these conclusions we add the following *caveats*. First, since the critical comparisons in this study have involved bilingual children, it is possible that the phenomenon we have discovered arises from a still more complex interaction (*i. e.*, interference pattern) between the linguistic structures of the native and second languages. Secondly, it must be remembered that all of our evidence relates to development during the concrete operations stage, and thus we are not suggesting that there is variability in the ordering of Piaget's developmental stages. Furthermore, even within our Greek and English samples we do not find that mastery of vector structures in language is either necessary or sufficient for the attainment of conservation. Although most theorists would agree in our conclusion that language plays a *contributory* role in cognitive development, there is disagreement about its relative importance *vis à vis* maturation (contrast, for example, Bruner, 1964; Leontiev, 1963 and Piaget). We attempted by regression analysis to assess the relative contributions of language competence and maturation, and we found that while both factors have a statistically significant "effect" (¹⁹), the influence of maturation is by far the stronger. This, of course, is consistent with Sinclair de Zwart's (1967, ch. 2) finding that formal training in language produces a *slight* improvement in conservation performance. Since many theoretically relevant aspects of language remain to be studied, these findings cannot settle the matter; nonetheless they do give a tentative guide to the relative importance of each factor and illustrate the use of new methods for studying such questions.

Our results raise the broad question of "linguistic relativity" in cognitive development. We have seen that there is a parallel between the structure of language and that of cognitive development. Where languages encode classification and difference relations into strictly separate grammatical forms there is a parallel cleavage in operational development; mastery of the comparative (vector) forms in such languages is associated with operational competence in dealing with *difference and equality relations* (*e. g.*, the conservation problems). However where languages permit classification and difference relations to be encoded in the same (scalar) grammatical form, there is

(¹⁹) We have used a vocabulary of "cause and effect" in discussing the regression analysis, although some might venture other explanations, *e. g.*, viewing language as a *dependent variable* (Anastasiou and Hanes, 1974). The results of the quasi-experimental comparisons provide a basis for our present interpretation.

no division in (concrete) operational development, and mastery of the comparative forms indicates only a higher level of *classification* ability.

These phenomena prompt us to recall the linguistic theories of Benjamin Whorf. In a treatise on the interrelationship of epistemology and language he wrote:

The phenomena of language are background phenomena of which talkers are (generally) unaware... These involuntary automatic patterns of language are not the same for all men but are specific to each language...

From this fact proceeds what I have called the "linguistic relativity principle", which means, in informal terms, that users of markedly different grammars are pointed by their grammars toward different types of observations and different evaluations of extremely similar acts, and hence are not equivalent as observers but must arrive at somewhat different views of the world. (1965, p. 221)

Stated as it is, in static terms, Whorf's relativity principle is both challenging and difficult to test. However, if we view it in the framework of genetic epistemology, we can see the rich variety of contrastive developmental studies which such a principle suggests. From this perspective, we might reword Whorf's concluding sentence to read: *'users of markedly different grammars are pointed by their grammars toward different types of observation with different cognitive consequences, and hence their intellectual development does not follow identical paths, but they deviate somewhat from each other in working through the basic patterns induced by maturation.'*

The present research is a tentative step toward the study of linguistic relativity within the context of developmental psychology. As with all such research, many further questions are raised. Initially, we shall be anxious to see our findings replicated with even larger samples of children. Work in this direction is already under way (Sevinç, 1977), but other crucial questions remain to be considered. For example, the study of other Turkic languages (*e. g.*, The Central Asiatic and Aralo-Caspian languages; see Menges, 1968) which encode comparisons in a manner similar to English will provide important evidence in verifying that the structure of the comparative is the *critical* linguistic factor in producing the patterns we have obtained.

The potential field of study, however, is not limited to the narrow focus with which we have begun, but rather it is as rich and wide as the variety of human grammars. The coding of difference and attribute relations is but one of the myriad aspects of language. The developmental consequences of grammatical variations in the handling of spatial, temporal, and causal relations, to name three promising candidates, remain to be studied, and development beyond the concrete operations stage has yet to be considered.

REFERENCES

- ALMY, M. *Logical thinking in the second grade*. New York: Teachers College Press, 1970.
ANASTASOW, N. & HANES, M. Cognitive development and the acquisition of language in three subcultural groups. *Developmental Psychology*, 1974, 10, 703-709.

- BARBIER DE MEYNARD, A. C. *Dictionnaire Turc-Français*, 2 vols., Paris : 1881 (reprinted, Amsterdam: Philo Press, 1971).
- BEILIN, H. Cognitive capacities of young children: a replication. *Science*, 1968, 162, 920-921.
- BENTLER, P. Monotonicity analysis: an alternative to linear factor and test analysis. In D. Green (Ed), *Measurement and Piaget*. New York: McGraw Hill, 1971.
- BEVER, T., MEHLER, J. & EPSTEIN, J. What children do in spite of what they know. *Science*, 1968, 162, 921-924.
- BRUNER, J. The course of cognitive development. *American Psychologist*, 1964, 19, 1-15.
- BRYANT, P. *Perception and understanding in the young child*. London: Methuen, 1974.
- BULL, W. *Time, tense and the verb*. Berkeley: University of California Press, 1963.
- DASEN, P. Cross-cultural Piagetian research: a summary. *Journal of Cross-Cultural Psychology*, 1972, 3, 23-29.
- DELILBASI, A. *Türkçeden Fransızcaya büyük lûgat*. Istanbul: Milli Eğitim Basmevi, 1946.
- GENCAN, T. *Dilbilgisi*. Istanbul: Fen Fakultesi Basmevi, 1971.
- GODEL, R. *Grammaire turque*. Genève : Université de Genève (École d'interprètes), 1945.
- GOODNOW, J. A test for milieu effects with some of Piaget's tasks. *Psychological Monographs*, 1962, 76, 1-22.
- HALL, J. & JONES, D. The social grading of occupations. *British Journal of Sociology*, 1950, 1, 31-53.
- HERON, A & DOWEL, W. The questionable unity of the concrete operations stage. *International Journal of Psychology*, 1974, 2, 1-9.
- HONY, H. *Turkish-English dictionary*. (2nd edition), Oxford: Oxford University Press, 1967.
- INHOLDER, B. & PIAGET, J. *The early growth of logic in the child*. London: Routledge and Kegan Paul, 1964.
- KELLEY, M., TENEZAKIS, M. & HUNTSMAN, R. Some unusual conservation behavior in children exposed to two cultures. *British Journal of Educational Psychology*, 1973, 43, 181-182.
- KLAHR, D. A Monte Carlo investigation of the statistical significance of Kruskal's nonmetric scaling procedure. *Psychometrika*, 1969, 34, 319-330.
- KRUSKAL, J. Multidimensional scaling by optimising goodness of fit to a non-metric hypothesis. *Psychometrika*, 1964, 29, 1-27.
- KRUSKAL, J. Nonmetric multidimensional scaling: a numerical method. *Psychometrika*, 1964, 29, 28-42.
- LEONTIEV, A. Principles of mental development and the problem of intellectual backwardness. In B. Simon and J. Simon (Eds.), *Educational psychology in the U.S.S.R.*, London: Routledge and Kegan Paul, 1963.
- LEWIS, G. *Turkish grammar*. Oxford: Oxford University Press, 1967.
- LLOYD, B. The intellectual development of Yoruba children. *Journal of Cross-Cultural Psychology*, 1971, 2, 29-38.
- MENGES, K. *The Turkic languages and peoples*. Wiesbaden: Harrasowitz, 1968.
- NEMETH, G. *Türkische grammatik*. Berlin: G. J. Göschen, 1916.
- PELUFFO, N. Les notions de conservation et de causalité chez les enfants provenant de différents milieux physiques et socio-culturels. *Archives de Psychologie*, 1962, 38, 275-291.
- PIAGET, J. *Child's conception of number*. London: Routledge and Kegan Paul, 1952.

- PIAGET, J. Nécessité et signification des recherches comparatives en psychologie génétique. *International Journal of Psychology*, 1966, 1, 1-13.
- PIAGET, J. & INHELDER, B. *Le développement des quantités chez l'enfant*. Neuchâtel : Delachaux et Niestlé, 1941.
- SEVINÇ, M. A cross-cultural study of the effects of migration upon the cognitive development of Turkish children (1977, in preparation).
- SINCLAIR DE ZWART, H. *Acquisition du langage et développement de la pensée*. Paris : Dunod, 1967.
- TORGERSON, W. *Theory and methods of scaling*. New York: Wiley, 1958.
- VERSEY, J. *A longitudinal study of some aspects of cognitive development in primary school children*. Unpublished Ph. D. Dissertation, University of London, 1974.
- WHORF, B. *Language, thought and reality*. Cambridge, Massachusetts: M.I.T. Press, 1956.

RÉSUMÉ

On a employé une méthode interculturelle pour sonder les implications théoriques de la corrélation connue entre la maîtrise des formes comparatives du langage et le développement de l'aptitude à utiliser les relations de différence et équivalence (telles que celles rencontrées dans les tâches piagétienne de conservation). Comme la langue turque permet les comparaisons sans recourir à des formes morphologiquement distinctes (par exemple, Jean est à Marie grand), elle fut choisie pour cette étude, ainsi que l'anglais et le grec qui possèdent un système analogue pour exprimer la comparaison. Cent dix écoliers anglais, cypriotes turcs et cypriotes grecs furent soumis à diverses épreuves de langage, conservation et classification multiple. Les résultats indiquent que l'aptitude linguistique joue un rôle significatif dans le cours du développement cognitif et que les variations de la structure du langage peuvent produire des variations parallèles de la structure du développement. Des analyses statistiques suggèrent les conclusions spécifiques suivantes : (1) le stade des opérations concrètes n'est pas fonctionnellement unifié; (2) la structure du développement pendant ce stade est multidimensionnelle; et (3) la constance interculturelle de la séquence du développement pendant ce stade provient, en partie, des ressemblances linguistiques quant à la représentation des relations d'attribut et de différence.

APPENDIX C

**Test and Task Procedures Used in Pilot Study:
Version used with English Children**

PILOT STUDY TEST PROTOCOL

PRETESTS:Provoked use of qualitative words:Same, fewer, more, less than

Apparatus:

L	:	5 red counters
M	:	4 green counters
N	:	5 Koh's blocks
O	:	3 Koh's blocks
P	:	10 sticks
Q	:	6 marbles

Instruction: Here are some groups of things. We have a group here (L) another here (M) a group here (N) a group here (O), another group here (P), and a group here (Q).

Instruction: Now look at this group (L). I want you to show me another group which has the same number as this group (L).

Instruction: Show me a group which has fewer than this group (L).

Instruction: Show me a group which has more than this group (L).

Instruction: Show me a group which has less than this group (L).

Provoked use of scalars and vectors:

Apparatus: Pencils: a short thick one — a long thin one

Instruction: Show me a pencil which is longer than this one

Instruction: Show me a pencil which is shorter and thicker than this one

Spontaneous use of qualitative words:A. Same, more, less = adapted from Sinclair-de-Zwart

Apparatus: Presenting two dolls, to one of whom we give 4 big marbles and to the other 2 small marbles.

Instruction: Look, I have given the dolls these marbles, (Q) is it fair?

Question : Why (not)?

Question : Can you make it fair?

Question : Is it fair now?

Question : Why?

B. Some

Apparatus: Two sets of marbles 16 and 24 in number

Instruction: Put some of your marbles in this box.

Spontaneous use of scalars and vectors: (from Sinclair-de-Zwart)
(Differences)

Apparatus: Two pieces of wood both painted the same color
a. 25 x .9 x .9 cm weight 15 gm
b. 10 x 4.6 x 4.6 cm weight 159 gm

Instruction: Here are two pieces of wood

Question : Can you tell me the difference between them?

Question : Can you tell me any other differences between them?

Instruction: Pick them up, one in one hand, one in the other.

Question : Can you tell me any difference between them?

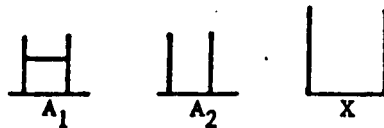
CONSERVATION OF CONTINUOUS QUANTITY (LIQUID)

- (1) Apparatus : Two cylindrical containers A_1, A_2 5 cm high with 4 cm internal diameter.

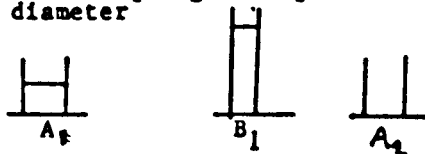
Instruction: I am going to pour some of this liquid (X) into this jar (A_2) and I want you to tell me to stop pouring when there is the same amount in this jar (A_2) as in this jar (A_1). Tell me to stop pouring when there is the same amount.

Question : Is there the same amount?

Question : Why?



- (2) Apparatus: Container A_1 , A_2 and B_1 13 cm high with 1.5 cm internal diameter



Question : Is there the same amount in this jar (B_1) as in this one (A_1)?

Question : Why (not)?

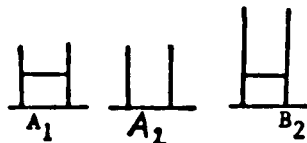
Question : Does one have more?

- (3) Apparatus: A_1 , A_2 and a cylindrical container of the same diameter as (A) but 10 cm high (B_2)

Instruction: I am going to pour some liquid from this jar (X) into this jar (B_2). Tell me to stop pouring when there is the same amount as in here (A_1).

Question : Is there the same amount?

Question : Why?



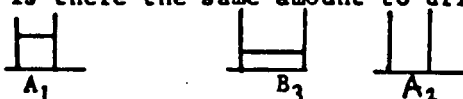
- (4) Apparatus : A_1 , A_2 and a standard glass beaker 7 cm high with 5.5 cm internal diameter B_3 .

Instruction: This time I want you to tell me to stop pouring when there is the same amount in this jar B_3 as in this one A_1 . Tell me to stop pouring when there is the same amount.

Question : Is there the same amount?

Question : Why? (not) ?

Question : Is there the same amount to drink?



- (5) Apparatus : A_1 , A_2 plus 4 smaller jars (A_{1-4}) each 3.5 cm high with 2 cm internal diameter

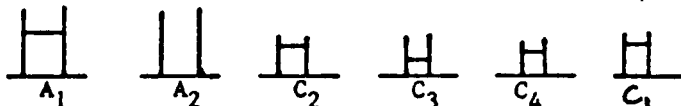
Instruction: I want you to tell me to stop pouring when there is the same amount in this jar (A_1) as in this jar (A_2). Tell me to stop pouring when there is the same amount.

Question : Is there the same amount?

Instruction: Now we have these jars. I am going to pour this one (A_1) into this jar (C_1) and this jar (C_2), and this jar (C_3), and this jar (C_4).

Question : Is there the same amount in all of these ($C_{1,2,3,4}$) as in there (A_2)?

Question : If I pour them back all together would it be the same amount?



* The liquid is not equally distributed among the small jars

CONSERVATION OF CONTINUOUS QUANTITY -- SOLID

Apparatus : 4 balls of plasticine in the ratio of volume 4-2-2-1
unit weight 25 gms

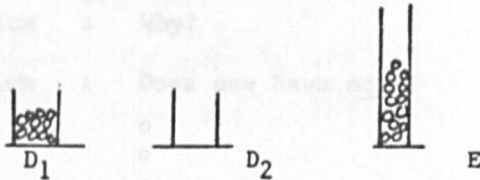
Instruction: Show me the balls which have the same amount of plasticine in them.

Prediction : If I roll this one into a sausage, will the sausage
Question : have the same amount as this ball? (Indicating
Roll

Question : Does this sausage have the same amount of plasticine as
this ball?

Question : Why (not)?

Question : Does one have more?

CONSERVATION OF DISCONTINUOUS QUANTITY -- (NUMBER)

Apparatus : 23 Multi-colored beads in a container

Instruction: We have some beads here and these jars. When I put a
bead in my jar (D_1), you put a bead in your jar (D_2).
Ready.

Question : Is there the same amount of beads in this jar (E) as
in this one (D_2)?

Question : Why(not)?

Question : Does one have more?

MAIN TASKS

DISCONTINUOUS QUANTITY (NUMBER) (13)

Apparatus: Two Heaps of Counters
 13 red counters
 15 green counters

Instruction: We are going to make towers. I want you to put a counter down every time I put a counter down. I put a counter down, you put a counter down.

Question : Are there the same number of counters in your tower as in my tower?

Question : Does one tower have more?

```

o   o
o   o
o   o
o   o
o   o
o   o
o   o   o

```

Instruction: I am going to put these down like this.

Question : Are there the same number in my cross as in your tower?

Question : Why?

Question : Does one have more?

```

o
o
o
ooo o ooo
o
o
o

```

CONSERVATION OF WEIGHT:

Apparatus : 4 balls of plasticine in the ratio of volume 4-2-2-1
 Unit weight 25 gms

Instruction: Show me the two balls which weigh the same

Prediction : If I roll this one into a sausage, will it weigh the same as this ball?

Question : Roll

Question : Does this sausage weigh the same as this ball?

Question : Why (not)?

Question : Does one weigh more?

SERIATION

The child is given a set of 10 sticks of varying lengths ranging from about 9 - 16 cms with 1 cm increment and is asked to form a seriation from the shortest (A) to the longest (K).

Procedure.

1. SHOW ME THE SMALLEST STICK
2. NOW FIND ONE THAT IS A TINY BIT BIGGER THAN THAT ONE.
3. SHOW ME THE BIGGEST
4. NOW TRY TO PUT THE SMALLEST FIRST THEN ONE A LITTLE BIT BIGGER, THEN ANOTHER A LITTLE BIT BIGGER, AND SO ON.
5. WE PUT THEM LIKE THIS, LOOK (A,B,C,). THEY MAKE A KIND OF STAIRCASE.
(this is the practice item)
(Giving him indications that the sticks would make a kind of staircase; when he has correctly arranged them in order of size)
n.b. before the child is asked to seriate the sticks are scrambled

In the event that the child arranges the sticks in a manner that is almost correct (i.e., one or two sticks out of place) the experimenter probes his understanding of the task by pointing out an erroneous placement and inquiring "look at this stick, is it in the right place?"

MATRIX TEST (adapted from Almy et al., 1970 and Inhelder and Piaget, 1964)

Practice Item -- Card I

Question : I am going to show you some cards with pictures on them. Here is one with circles and squares on it. There is a place for one more shape (pointing to the blank space).

Question : Which one of these belongs here? (interviewer indicates the possible alternatives which are contained on the opposite flap of the folder.

That is, which one fits best this way (horizontally), and this way (vertically)? (interviewer indicates horizontal and vertical directions with his finger)

(After S has selected an alternative, Interviewer places it in ^Amatrix and asks), How can you tell it goes best with the others?

If S gives the correct response and explanation, the interviewer says: That is right, this row has things that are the same shape (pointing to the horizontal row), AND this row has things that are the same size (pointing to the vertical row).

If S has not been able to choose the correct card, or if he has chosen the card but is unable to articulate the correct reason for doing so, the interviewer places the correct card in the matrix saying:

This is the correct one. This goes best with the others. The things in this row (pointing to ^Ahorizontal row) are the same shape, and the things in this row are the same size (pointing to ^Avertical row).

END PRACTICE

Question: When I showed you the shapes, there were 4 choices and the right one happened to be in the last position. In some of the ones I am going to show you now there are more choices, but the correct card can be any place—4th, 1st, 3rd, or anywhere. Now let us look at some more pictures. (Interviewer presents second matrix) Here is a picture with a blank space, you must try and figure out which picture fits best in the blank space, that is, find the one which fits best this way (point to horizontal) and this way (vertical).

(After the subject has made his choice, the interviewer inserts the card into the blank space and inquires), is this all right?

If the child says it is all right, continue

If a child indicates not, ask again, which fits best with all the others? (and return the choice to its position with the other alternatives).

Repeat this procedure until a child has made his choice and is stable.

Question : How can you tell this is the best one?

note: If child does not give full response, probe with, why does this one fit best with the others?

Question : Is there any other one that would fit as well or better?

End Matrix I

For all of the following matrices the same questioning procedure will be followed. The experimenter commences by asking:

Question : Now in this one, which of these pictures fits best this way (horizontally) and this way (vertically) with the other pictures?

The procedure follows as above.

APPENDIX D

**Test and Task Procedures Used in Pilot Study
Version used with Turkish Children**

BASE-LINE TESTS - Pilot Study

Provoked Use of Qualitative Words:

- Malzeme : (L)-5 kırmızı marka
(M)-4 yeşil marka
(N)-5 tahta blok
(O)-3 tahta blok
(P)-10 çubuk
(Q)-6 bilye
- Açıklama : Burada guruplar halinde bazı şeyler
görüyorsunuz.
Bir gurup burada (L), başkabir gurup burada (M),
bir gurup burada (N), başkabiri burada (O),
bir gurup hurada (P), bir tane de burada (Q).
- Talimat : Şimdi bu guruba bak (L). Bana bu gurupla (L)
aynı sayıda olan başka bir gurup gösterebilir
misin?
- Talimat : Bana bu guruptan (L) daha seyrek olan bir
gurup göster.
- Talimat : Bana bu guruptakinden (L) daha çok olan bir
gurup göster.
- Talimat : Bana bu guruptakinden (L) daha az olan
bir gurup göster.
-

Provoked Use of Scalars and Vectors:

- Malzeme : 3 kalem
a. kısa ve kalın
b. uzun ve ince
c. standard 15 cm. uzunluğunda
- Talimat : Bana bundan daha uzun olan bir kalem göster(c).
- Talimat : Bana bundan daha kısa ve daha kalın olan
bir kalem göster(c).

Spontaneous Use of Scalars and Vectors:

(Differences)

- Malzeme : İki aynı renkte boyanmış tahta cisim
a. (25 x .9 x .9 cm. büyüklüğünde,
15 gr. ağırlığında)
b. (10 x 4.6 x 4.6 cm. büyüklüğünde,
160 gr. ağırlığında)
- Açıklama : Burada iki tahta cisim görüyorsun.
- Soru : Bana aralarındaki farkı söyleyebilir misin ?
- Soru : Bana ikisinin arasında başka bir fark söyleyebilir misin ?
- Talimat : Birini bir eline, öbürünü diğer eline al.
- Soru : Bana aralarında başka bir fark söyleyebilir misin ?
-

Spontaneous Use of Qualitative Terms :

(Aynı, daha çok, daha az)

- Malzeme : İki bebek
4 büyük bilye, 2 küçük bilye
- İşlem : İki bebekten birine 4 büyük bilye ve diğerine 2 küçük bilye verilir.
- Talimat : Bak, bebeklere bu bilyeleri verdim.
- Soru : Kardeş payı mı oldu ?
- Soru : Neden evet veya hayır ?
- Soru : Kardeş payı yapabilir misin ?
- Soru : Şimdi tamam mı ?
- Soru : Neden ?

Conservation of Discontinuous Quantity:

(Number)

- Malzeme : 23 değişik renklerde bilyeler
2 eşit büyüklükte cam kap (A_1 , A_2)
1 uzun ve ince silindir cam kap (B_1)
- Talimat : Burada birçok bilye ve bu kaplar var. Ben kendi kabıma bir bilye koyduğum zaman (A_1), sen de kendi kabına bir bilye koy (A_2).
Hazır mısın ?
- İşlem : Birbiri ardına 20 bilye iki kaba dağıtılır.
Geriye 3 bilye kalır.
- Talimat : Ben kendi bilyelerimi bu kaptan (A_1) bu kaba (B_1) boşaltıyorum.
- Soru : Bu kap içindeki (B_1) bu kap içindekilerle (A_2)
aynı miktarda mı ?
- Soru : Neden evet veya hayır ?
- Soru : Birinde daha çok mu var ?
-

(Number)

- Malzeme : 2 küme değişik renkte marka
a. 13 kırmızı marka
b. 15 yeşil marka
- Talimat : Şimdi bu markalarla iki kule yapacağız. Ben yere bir marka koyduğum zaman sen de yere bir marka koyacaksın.
Ben yere bir marka koyuyorum, sen de yere bir marka koy.
- Soru : Senin kulendeki markalar benim kulemdekilerle
aynı sayıda mı ?
- Soru : Bir kulede daha çok mu var ?
- Talimat : Benimkileri bu şekilde yere koyacağım.
- Soru : Benim şeklimle senin kulende aynı sayı mı var ?
- Soru : Neden ?
- Soru : Birinde daha çok mu var ?

Conservation of Continuous Quantity:

(Solid)

Malzeme : 4 macun top- birbirlerine orantıları 4-2-2-1

4,2 -karışık renklerde

2,1 - tek renkte

Talimat : Bana içinde aynı miktar macun olan topları göster.

Tahmin sorusu: Bunu sosis yaparsam, sosiste ve bu topta
aynı miktar macun mu olacak ?

İşlem : Toplardan biri sosis şekline getirilir.

Soru : Bu sosisle bu topta aynı miktar macun mu var ?

Soru : Neden evet veya hayır ?

Soru : Birinde daha çok mu var ?

Conservation of Weight:

(Solid)

Malzeme : 4 macun top- birbirine ağırlık orantıları

4-2-2-1

4,2 - karışık renklerde

2,1 - tek renkte

Talimat : Bana aynı ağırlıkta olan iki top göster.

Tahmin Sorusu : Birini sosis haline getirirsem bu topla aynı
ağırlıkta mı olacak ?

İşlem : Toplardan biri sosis şekline getirilir.

Soru : Bu sosis bu topla aynı ağırlıkta mı ?

Soru : Neden evet veya hayır ?

Soru : Biri daha mı ağır ?

Conservation of Continuous Quantity:

(Liquid)

Subtask A: Eşitlik

- Malzeme : a. 2 küçük silindir şeklinde cam kap (A_1 , A_2)
6 cm. uzunluğunda, 4 cm. genişliğinde
Bunlardan A_1 renkli bir suyla yarıya kadar
doldurulur. Diğer boş bırakılır.
b. 15 cm. uzunluğunda 10 cm. genişliğinde renkli
suyla dolu şeffaf bir kap (X).
- Talimat : Gördüğünüz bu sıvının bir miktarını bu kaba (A_2)
boşaltacağım.
Bana bu kapla (A_2) bu kap (A_1) arasında aynı
miktar su olduğu zaman durmamı söyle. Bana iki
kapta da aynı miktar olduğu zaman dur de.
- Soru : Aynı miktar mı ?
- Soru : Neden ?

Subtask B: Yer değiştirme

- Malzeme : a. (A_1) yarı dolu
b. 13 cm. uzunluğunda, 2 cm. genişliğinde
silindir şeklinde bir kap (B_1)
- Talimat : Bu kabı (A_2) bu kaba (B_1) boşaltacağım.
- Soru : Bu kaptaki su miktarı (B_1) bundakiyle aynı mı ?
- Soru : Neden evet veya hayır?
- Soru : Birinde daha çok mu var ?

Subtask C : Eşitlik Ayarlaması

- Malzeme : a. A_1 yarı dolu, A_2
b. A 'larla aynı genişlikte fakat 8 cm uzunlukta
silindir şeklinde başka bir cam kap (B_2).
- Talimat : Ben bu kaptaki (X) sıvıdan bir kısmını bu kaba (B_2)
boşaltacağım. Bu kaptaki (A_1) su ile aynı miktar
su olduğu zaman bana durmamı söyle.
- Soru : Aynı miktar mı ?
- Soru : Neden ?

Subtask D : Genelleştirme

- Malzeme : a. (A_1) yarı dolu
b. 10 cm. uzunluğunda 7 cm. genişliğinde silindir şeklinde bir cam kap
- Talimat : Ben bu kaptan (X) bu kaba (B_3) bir miktar su boşaltacağım. Bu sefer bana bu kapla (B_3) bu kap (A_1) içinde aynı miktar su olduğu zaman durmamı söyle.
- Soru : Aynı miktar mı ?
- Soru : Neden ?
- Soru : İçilecek su miktarı aynı mı ?

Subtask E : Bölüştürme

- Malzeme : a. (A_1) yarı dolu, (A_2)
b. 2.5 cm. genişliğinde, 3.5 cm. uzunluğunda 4 eşit silindir şeklinde cam kap (C_{1-4})
- İşlem : Subtask A da olduğu gibi eşitleştirme
- Talimat : Bana bu kapla (A_1) bu kap ^(A_2) içinde aynı miktar su olduğu zaman durmamı söyle.
- Soru : Aynı miktar mı ?
- Soru : Neden ?
- Talimat : Şimdi bu kapları görüyoruz. Elimdeki kabı (A_1) bu kabın içine (C_1), biraz bu kaba (C_2), bu kaba (C_3), biraz da bu kaba (C_4) boşaltacağım.
- Soru : Bunların hepsinin içindeki ($C_{1,2,3,4}$) miktar bunun içindekiyle aynı mı ?
- Soru : Bunların hepsini biraraya koyarsam ^(A_2) aynı miktar mı olacak ?

Matrices : Multiple Classification

Malzeme : 9 deęişik tablo
(Inhelder, Piaget, 1964 pp.159-69)
Tabloda boş kısma uyacak bütün seçimler deneye aynı anda gösterilir. Bunlardan biri deneyci tarafından boş kısma çocuęun isteęi üzerine yerleştirilir; ta ki denek kat'ı kararını verinceye kadar.

Matrix 1 : Alıştırma itemi

Talimat : Sana içinde resimler olan bazı kartlar gösterē -
ceğim. Bir tanesinde yuvarlaklar ve kareler var.
Resimlerden bir tanesi eksik (boş kısma işaret edilir)
Bana bunlardan (seçenek resimlerine işaret edilir)
hangisinin buraya (boş yere) uyacağını gösterir
misin? Şöyle ki boş yere resmi koyduğumuz vakit
resimler böyle (yanlamasına) ve böyle (uzunlaması-
na) baktığımızda birbirine uysun.
Şimdi en uygununu bul bakalım.

Soru : Neden onu seçtin ?

Soru : Ondan daha iyi uyacak başka bir tane var mı ?

Soru : Neden ?

Çocuk doğru cevabı ve izahatı verdiği takdirde
deneyci şöyle der:

Evet doğru. Bu sırada aynı şekil resimler var
(yanlamasına sırayı işaret ederek) bu sırada da
şekiller aynı büyüklükte (uzunlamasına sırayı
işaret ederek) .

Eğer çocuk doğru seçimi yapmamışsa, veya doğru
seçimi yapıp izahatını vermemişse, deneyci doğru
kartı boş yere yerleştirip şöyle der:

Dięer resimlerle en iyi uyan kart bu. Bu sıradaki
resimlerin (yanlamasına) hepsi aynı şekilde, bu
sıradaki resimlerin (uzunlamasına) hepsi ise
aynı büyüklüklüktedir.

Not : Bu izahat sadece birinci kart için yapılır.

MATRIX 2-9

Talimat : Şimdi bu karta bakalım. Bana bu resimler arasından (seçenek kartlarına işaret ederek) bu boş yere en iyi uyacak bir resim göster; şöyleki bu tabloya bu şekilde (yanlamasına) ve bu şekilde (uzunlamasına) baktığımız vakit diğerlerine uysun.

Soru : Neden onu seçtin ?

Soru : Daha iyi uyacak başka bir resim var mı ?

SERiation :

Malzeme : 10 tane tahta çubuk, aynı renkte en kısası 9 x 0.9 x 0.9 cm. uzunlukta ve diğer 9 ise 1 cm. farklılıkta

İşlem : Çubuklar karmaşık halde masa üzerine bırakılır.

Talimat : Burada bu çubukları görüyorsun. Bana bunlardan en küçüğünü gösterir misin ?

Talimat : Ondan az biraz büyüğünü göster.

Talimat : Şimdi en büyüğünü göster.

Talimat : Ondan az biraz küçüğünü göster.

Talimat : Şimdi bu çubukları en küçüğünden başlayıp en büyüğüne doğru merdiven şeklinde sırala. Önce en küçüğünü, sonra biraz daha büyüğünü, biraz daha büyüğünü, vs.. Bitirdiğin vakit çubuklar merdiven şeklinde olsun. Şimdi başla.

Soru : Bitti mi ?

İşlem : Çocuk bir iki yanlış sıralamayla diziyi bitirdiği vakit deneyici sorar:

Soru : Daha iyi yapabilir misin ?

APPENDIX E

**Test and Task Procedures Used in Pilot Study
Version used with Greek Children**

BASE-LINE TESTS

Spontaneous use of scalars and vectors

Differences

!Տոս թշնամի քծոթաբոր Վն Նշն զոի ք Նշնծաք : Ասեմծն,
 •օղբ ք մոս Վն Նշն զոի ք Նշնծաք : Նշնկնո,
 !Տոս թշնամի Նշնծաբոր Նշն Նշն զոի ք Նշնծաք : Ասեմծն,
 !Տոս թշնամի քծոթաբոր Վն Նշն զոի ք Նշնծաք : Ասեմծն,
 •օղբն Նշնծաբոր Նշն Նշն զոի ք Նշնծաք : Նշնկնո,

(A) Օճղկոյն : Կողմէ, հետաքրքիր է նաեւ հայտնի դարձաւ.

ἡμετέρας : ὁμοίας :

:(1XQ) 2101 : 4061003.

Επώνυμο : Χρηστίδης υφ ιδ κληρείς & κληρείς

ΕΡΩΤΗΣΕΙΣ : ΤΙΣ ΕΙΝΑΙ ΟΙ ΣΥΝΑΡΤΗΣΕΙΣ ;

Epithelium : Tactile;

(B) 08ηλϵζ. : Βδλϵ ηερικϵς ρκδ ρϵ ηϵλϵλϵντ ϑι ρομ ϑοηϵ ϑο ροηϵ.

Provoked use of scalars and vectors

- Μολύβια : Ένα κοντό παχύ μολύβι και ένα μακρό λεπτό μολύβι
 'Οδηγίες : Δεῖξε μου ένα μολύβι που είναι μακρύτερο από αυτό
 'Οδηγίες : Δεῖξε μου ένα μολύβι που είναι κοντότερο και παχύτερο από αυτό.

Provoked use of Qualitative Words

"Ιδια, λιγότερα, περισσότερα (λιγότερα)

(No distinction in Greek between "less than" and "fewer than" as applied to continuous and discontinuous objects respectively)

5 κόκκινα πούλια

4 πράσινα πούλια

6 μπέλλιες

- 'Οδηγίες : Έδω έχουμε μερικές ομάδες από πράγματα. Έχουμε μία ομάδα έδω (L) μία άλλη έδω (M), μία ομάδα έδω (N), μία άλλη έδω (O), μία άλλη έδω (P), μία ομάδα έδω (Q), μία ομάδα έδω (R) και μία ομάδα έδω ().
- 'Οδηγίες : Τώρα κοίταξε αυτή την ομάδα (L). Θέλω να μου δείξεις μία άλλη ομάδα που να έχει τόν ίδιο αριθμό με αυτή την ομάδα (L).
- 'Οδηγίες : Τώρα κοίταξε αυτή την ομάδα (). Θέλω να μου δείξεις μία άλλη ομάδα που να έχει τόν ίδιο αριθμό με αυτή την ομάδα ().
- 'Οδηγίες : Δεῖξε μου μία ομάδα που να έχει λιγότερα από αυτή την ομάδα ().
- 'Οδηγίες : Δεῖξε μου μία ομάδα που να έχει περισσότερα από αυτή την ομάδα ().
- 'Ερώτηση : Δεῖξε μου μία ομάδα που να έχει λιγότερα από αυτή ().

!nd31900103u 13X3 n33 91 Smu4H : 4041033.

!2171 : 4441003.

!oIdgu nom gxiq agim

Ծագումնաբանական հարցերի վերաբերյալ : Ամենօրե.

.089465 : B d b d x a b d x p i s e p e

Երկրորդ, համաձայն ինքնուրույն հետազոտության արդյունքների՝

!noH gk1g v91o jmk omg o1d9u

[illegible]

10. The following information is provided for the year ended 31 December 2018:

- ԲԱ ՄՏԲԸ ԾԼՅ, • ԻՎԾՈՒ ՄԱՅ ՄԻԲԱ ՄՏԲԸ ԾԼՅ ԴՈՒ ԲԾՈՒ ՀԵՐԱ
ԻՎԾՈՒ ՄԱՅ ՄԻԲԱ ՏԻՇՏԲԸ ԲՆ ՄԵՅԹ • ՏՈՒԼԾՈՒ ՀԻՄՆԵՐԻՈՒ ԲԹ : ՏՅԼԼԳՈ.

DISCONTINUOUS QUANTITY (NUMBER)

Տեղեկություններ 13X3 մոդի և համարներ : Կոմիտեի.

ΕΡΩΤΗΣΗ : (1XQ) ΓΙΑΤΙ :

(20) Կարգի ընթացքում (3) սահմանված:

Այս փորձի արդյունքները համընկնում են փորձի 1-ին փուլի արդյունքներին, և համընկնում է,

• (3) արքունի և արքուն.

(10) արքայ և ևս զք ռոմ հօրհրդի հի արքայի ք : հայկացո.

1011013

20. (D2) $\neg \exists x (Ax \wedge Bx) \rightarrow \forall x (Ax \rightarrow \neg Bx)$

[illegible]

• Տեղքով հյի հնչդոս յառ հաժմարժ հյի հնչդոս տիոս՝ զքչ, : հաշկնցո,

CONSERVATION OF DISCONTINUOUS QUANTITY (NUMBER)

CONSERVATION OF CONTINUOUS QUANTITY (LIQUID)

CONSERVATION OF WEIGHT

- SUBTEST (1)
- *Οδηγίες : Δεῦξε μου τὲς μπάλλες ποὺ ζυγίζουν τὸ ἴδιο.
- *Ερώτηση : Ἐάν τὴν κᾶνω λουκάνικο θὰ ζυγίσω τὸ ἴδιο μὲ αὐτὴ τὴ μπάλλα;
- (Roll)
- *Ερώτηση : Αὐτὸ τὸ λουκάνικο ζυγίζει τὸ ἴδιο μὲ αὐτὴ τὴ μπάλλα;
- *Ερώτηση : Γιατὶ (ὄχι);
- *Ερώτηση : Μήπως τὸ ἕνα ζυγίζει περισσότερο;

CONSERVATION OF CONTINUOUS QUANTITY (SOLID)

- *Οδηγίες : Δεῦξε μου τὲς μπάλλες ποὺ ἔχουν τὴν ἴδια ποσότητα ἀπὸ πλαστελίνη.
- *Ερώτηση : Ἐάν τὴν κᾶνω λουκάνικο τότε τὸ λουκάνικο θὰ ἔχει τὴν ἴδια ποσότητα μὲ αὐτὴ τὴ μπάλλα;
- (Roll)
- *Ερώτηση : Αὐτὸ τὸ λουκάνικο ἔχει τὴν ἴδια ποσότητα πλαστελίνης μὲ αὐτὴ τὴ μπάλλα;
- *Ερώτηση : Γιατὶ (ὄχι);
- *Ερώτηση : Μήπως τὸ ἕνα ἔχει περισσότερη;

SUBTEST (5)

CONSERVATION OF CONTINUOUS QUANTITY (LIQUID)

SUBTEST (1)

*Οδηγίες : Θα χύσω λίγο από αυτό το υγρό (X) σε αυτή τη γυάλα (A2) και θέλω να μου πεις να σταματήσω να χύνω όταν θα έχουμε την ίδια ποσότητα σε αυτή τη γυάλα (A2) όσο και σε αυτή τη γυάλα (A1). Πες μου να σταματήσω να χύνω όταν έχουμε την ίδια ποσότητα.

*Ερώτηση : Έχουμε την ίδια ποσότητα;

*Ερώτηση : Γιατί;

SUBTEST (2)

*Οδηγίες : Θα χύσω αυτή τη γυάλα (A2) σε αυτήν (B1).

*Ερώτηση : Έχουμε την ίδια ποσότητα σε αυτή τη γυάλα (B1) όσο και σε αυτή τη γυάλα (A1);

*Ερώτηση : Γιατί (όχι);

*Ερώτηση : Μήπως ή μία έχει περισσότερο;

SUBTEST (3)

*Οδηγίες : Θα χύσω λίγο υγρό από αυτή τη γυάλα (X) σε αυτήν (B2). Πες μου να σταματήσω να χύνω όταν έχουμε την ίδια ποσότητα όσο και εδώ (A1).

*Ερώτηση : Έχουμε την ίδια ποσότητα;

*Ερώτηση : Γιατί;

SUBTEST (4)

*Οδηγίες : Αυτή τη φορά θέλω να μου πεις να σταματήσω να χύνω όταν έχουμε την ίδια ποσότητα σε αυτή τη γυάλα (B3) όσο και σε αυτή (A1).

*Ερώτηση : Έχουμε την ίδια ποσότητα;

*Ερώτηση : Γιατί;

*Ερώτηση : Έχουμε την ίδια ποσότητα να πούμε;

(5) SUBTEST

[illegible]

(A).

!n1619m0x m92j v41 3nnoX3 : 4m419d3.

4. (1) 1990-1991-1992-1993-1994-1995-1996-1997-1998-1999-2000-2001-2002-2003-2004-2005-2006-2007-2008-2009-2010-2011-2012-2013-2014-2015-2016-2017-2018-2019-2020-2021-2022-2023-2024-2025-2026-2027-2028-2029-2030-2031-2032-2033-2034-2035-2036-2037-2038-2039-2040-2041-2042-2043-2044-2045-2046-2047-2048-2049-2050-2051-2052-2053-2054-2055-2056-2057-2058-2059-2060-2061-2062-2063-2064-2065-2066-2067-2068-2069-2070-2071-2072-2073-2074-2075-2076-2077-2078-2079-2080-2081-2082-2083-2084-2085-2086-2087-2088-2089-2090-2091-2092-2093-2094-2095-2096-2097-2098-2099-2100-2101-2102-2103-2104-2105-2106-2107-2108-2109-2110-2111-2112-2113-2114-2115-2116-2117-2118-2119-2120-2121-2122-2123-2124-2125-2126-2127-2128-2129-2130-2131-2132-2133-2134-2135-2136-2137-2138-2139-2140-2141-2142-2143-2144-2145-2146-2147-2148-2149-2150-2151-2152-2153-2154-2155-2156-2157-2158-2159-2160-2161-2162-2163-2164-2165-2166-2167-2168-2169-2170-2171-2172-2173-2174-2175-2176-2177-2178-2179-2180-2181-2182-2183-2184-2185-2186-2187-2188-2189-2190-2191-2192-2193-2194-2195-2196-2197-2198-2199-2200-2201-2202-2203-2204-2205-2206-2207-2208-2209-2210-2211-2212-2213-2214-2215-2216-2217-2218-2219-2220-2221-2222-2223-2224-2225-2226-2227-2228-2229-2230-2231-2232-2233-2234-2235-2236-2237-2238-2239-2240-2241-2242-2243-2244-2245-2246-2247-2248-2249-2250-2251-2252-2253-2254-2255-2256-2257-2258-2259-2260-2261-2262-2263-2264-2265-2266-2267-2268-2269-2270-2271-2272-2273-2274-2275-2276-2277-2278-2279-2280-2281-2282-2283-2284-2285-2286-2287-2288-2289-2290-2291-2292-2293-2294-2295-2296-2297-2298-2299-2300-2301-2302-2303-2304-2305-2306-2307-2308-2309-2310-2311-2312-2313-2314-2315-2316-2317-2318-2319-2320-2321-2322-2323-2324-2325-2326-2327-2328-2329-2330-2331-2332-2333-2334-2335-2336-2337-2338-2339-2340-2341-2342-2343-2344-2345-2346-2347-2348-2349-2350-2351-2352-2353-2354-2355-2356-2357-2358-2359-2360-2361-2362-2363-2364-2365-2366-2367-2368-2369-2370-2371-2372-2373-2374-2375-2376-2377-2378-2379-2380-2381-2382-2383-2384-2385-2386-2387-2388-2389-2390-2391-2392-2393-2394-2395-2396-2397-2398-2399-2400-2401-2402-2403-2404-2405-2406-2407-2408-2409-2410-2411-2412-2413-2414-2415-2416-2417-2418-2419-2420-2421-2422-2423-2424-2425-2426-2427-2428-2429-2430-2431-2432-2433-2434-2435-2436-2437-2438-2439-2440-2441-2442-2443-2444-2445-2446-2447-2448-2449-2450-2451-2452-2453-2454-2455-2456-2457-2458-2459-2460-2461-2462-2463-2464-2465-2466-2467-2468-2469-2470-2471-2472-2473-2474-2475-2476-2477-2478-2479-2480-2481-2482-2483-2484-2485-2486-2487-2488-2489-2490-2491-2492-2493-2494-2495-2496-2497-2498-2499-2500-2501-2502-2503-2504-2505-2506-2507-2508-2509-2510-2511-2512-2513-2514-2515-2516-2517-2518-2519-2520-2521-2522-2523-2524-2525-2526-2527-2528-2529-2530-2531-2532-2533-2534-2535-2536-2537-2538-2539-2540-2541-2542-2543-2544-2545-2546-2547-2548-2549-2550-2551-2552-2553-2554-2555-2556-2557-2558-2559-2560-2561-2562-2563-2564-2565-2566-2567-2568-2569-2570-2571-2572-2573-2574-2575-2576-2577-2578-2579-2580-2581-2582-2583-2584-2585-2586-2587-2588-2589-2590-2591-2592-2593-2594-2595-2596-2597-2598-2599-2600-2601-2602-2603-2604-2605-2606-2607-2608-2609-2610-2611-2612-2613-2614-2615-2616-2617-2618-2619-2620-2621-2622-2623-2624-2625-2626-2627-2628-2629-2630-2631-2632-2633-2634-2635-2636-2637-2638-2639-2640-2641-2642-2643-2644-2645-2646-2647-2648-2649-2650-2651-2652-2653-2654-2655-2656-2657-2658-2659-2660-2661-2662-2663-2664-2665-2666-2667-2668-2669-2670-2671-2672-2673-2674-2675-2676-2677-2678-2679-2680-2681-2682-2683-2684-2685-2686-2687-2688-2689-2690-2691-2692-2693-2694-2695-2696-2697-2698-2699-2700-2701-2702-2703-2704-2705-2706-2707-2708-2709-2710-2711-2712-2713-2714-2715-2716-2717-2718-2719-2720-2721-2722-2723-2724-2725-2726-2727-2728-2729-2730-2731-2732-2733-2734-2735-2736-2737-2738-2739-2740-2741-2742-2743-2744-2745-2746-2747-2748-2749-2750-2751-2752-2753-2754-2755-2756-2757-2758-2759-2760-2761-2762-2763-2764-2765-2766-2767-2768-2769-2770-2771-2772-2773-2774-2775-2776-2777-2778-2779-2780-2781-2782-2783-2784-2785-2786-2787-2788-2789-2790-2791-2792-2793-2794-2795-2796-2797-2798-2799-2800-2801-2802-2803-2804-2805-2806-

2417 (A) ;

[illegible]

APPENDIX F

Codebook for Pilot Study: English and Cypriot Samples

Card 1:

Column

description

Coding Instructions

1 Language group 1=Turkish; 2=Greek; 3=English

2-3 two-digit identification number

4 school 1) Alexandra Park junior school
2) Alexandra Park infants school
3) South Haringey junior school
4) South Haringey infants school

5-8 age in years and months, n.b. first 2 digits are years; last 2 digits are months - e.g., 0906=nine years and six months

SEX M or F

0 fathers occupation - Hall jones code

total number of brothers and sisters

n.b. if more than 9 code the letter A

Year	1990	1991	1992	1993
1990	1991	1992	1993	1994

Pencil Pre-test

```
12      code "1" if subject used scalars
```

13 code a "1" if subject used vectors and his language was English
if Greek or Turkish

1- daha büyük forms

2= bu ondan büyük forms

3- both 1+2 types are used

Card 1:
Column

description

- 14 code a "1" if child uses a superlative form
 greeks- 1 to pio megalo
 2 to megalitero
 3 both
- 15 code a "1" if child ^{uses} tiny-tiny; kucucuk, etc. forms, size
 difference
- 16 code a "1" if child employs bi-partite scalars
 e.g. This is big and that is small
- 17 code a "1" if child employs a degenerative comparative in English
 or Greek
 e.g., This is big than that.
- 18 code a "1" if child uses "Medium-sized" to imply an ordering.
- _____

Marble-Doll pre-test

- 19 code "1" if subject used vector "more/less" Turkish, Greek
 equivalents
- 20 code "1" if subject mentions number of marbles
- 21 code "1" if subject mentions any other reason for distribution
 being unfair
- 22 code "1" if after redistribution child uses words equal, same, etc.
 to justify redistribution

Card 1:
Column

description

23 code "1" if after redistribution child uses only SIZE to justify
 code "2" if after redistribution child uses only NUMBER as
 justification
 code "3" if child uses BOTH size and number as justification

24	Result of redistribution	1) equal numbers
		2) equal numbers; same sizes

Spontaneous use of scalars and vectors

25 code "1" if child uses subjective scalars (big, etc.)

26 English: code "1" if child uses correct comparative form
 code "2" if child uses incorrect comparative form
 (e.g. more good)
 code "3" if child uses both correct and incorrect

Turk-Greek "daha" form = 1

 bu ondan ok form = 2

 1 and 2 = 3

is used

27 if superlative form_A code "1"

greek (1) to pio macri

(2) to mārītero

(3) both

28 if child uses kucucuk, tiny-tiny, etc. code "1"

Card 1: .
Column

description

29 if child (English/Greek) uses degenerative comparative code "1"
e.g. This is Big than that

30

Provoked use of Qualitative Words

31 code "1" if child understands same/equal

32 code "1" if child understands Fewer [code "2" if he points out^{to} 2
groups]

33 code "1" if child under_{stands} MORE [code "2" if he points out^{to} 2
groups]

34 code "1" if child understands LESS [code "2" if he points out^{to} 2
groups]

Beads-test

35 code "1" if subject says he has^{the} same amount

36 Why? code response

- 1) I counted them
- 2) you put one-I put one
- 3) other-level

37 After pouring--same? code "1" if child says they are^{the} same

Card 1:
Column

description

- 38 1) Why? (1st reason) 1 = You put one; I put one
- 39 2) Why? (2nd reason) 2 = I counted them
- 40 3) Why? (3rd reason) 3 = Inversion-reversibility
- 4 = reciprocity
- 5 = Addition-subtraction
- 6 = equality
- 7 = identity
- 8 = state of operations
- 9 = perceptual
- 0 = don't know or No answer
- 41 stable? if subject does not change answer; code "1"
- _____

Counters-cross

- 42 code "1" if subject says they are the same number
- 43 Why? code response 1) you put one-I put one
- 2) I counted them
- 3) other
- 44 After making into cross-code "1" if child says they are still the same number.
- 45 Why? (1st reason) 1) you put one-I put one
- 46 Why? (2nd reason) 2) I counted them
- 47 Why? (3rd reason) 3) Inversion-reversibility

Card 1:
Column

description

- 4) reciprocity
- 5) Addition-subtraction
- 6) equality
- 7) identity
- 8) state of operations
- 9) perceptual
- 0) don't know or No Answer

48 stable? code "1" if subject does not change answer.

Plasticene-quantity

- 49 code "1" if subject "PREDICTS" equality
- 50 code "1" if subject "JUDGES" equality
- 51 Why? (1st reason)
- 52 Why? (2nd reason) CODE by 7 conservation categories
- 53 Why? (3rd reason) (-see separate list)
- 54 stable? Code "1" if child does not change answer.
- _____

Plasticene-weight

- 55 code "1" if subject predicts equality
- 56 code "1" if subject judges equality

Card 1:

Column	description
57	Why? (1st reason)
58	Why? (2nd reason) code according to conservation categories
59	Why? (3rd reason) --see separate sheet
60	stable? code "1" if child does <u>not</u> change answer.

LIQUID-conservation

a) initial

61	agrees to initial equality "1" = YES
62	rationale: 1) same level 2) same size jars 3) same level and same size jars 4) other irrelevant reasons

b) tall-narrow jar

63	judges to be equal-code "1"
64	Why? (1st reason)
65	Why? (2nd reason) code according to conservation categories
66	Why? (3rd reason) --see separate sheet
67	stable? code "1" if subject does <u>not</u> change answer.

c) Distractor

68	judges to be equal-code "1"
69	why? code 1 = same level

Card 1:
Column

description

code 2 = same size jars

code 3 = same level and same size

70 stable? code 1 if child does not change answer

d) Pour into wide container

71 code "1" if subject stops below level in comparison fat jar.

72 code "1" if either

A) subject stopped below level in fat jar and says they are
equal

or B) if subject stopped at or above level in fat jar and says
they are UNEQUAL (with correct rationale)

73 Why? (1st reason)

74 Why? (2nd reason) code according to conservation categories

Why? (3rd reason) --see separate sheet

stable? code "1" if subject does not change answer

77

78

79

80 number 1 in this column. (card number).

Card 2:
Column

description

- 1 Language Group 1 = Turkish 2 = Greek 3 = English
- 2-3 two digit I.D. number (same as CARD 111)

LIQUID - SUM/DIVISION

- 4 code "1" if subject agrees that amount in standard "1" is the same
 as in standard "2"
- 5 code "1" if subject says that there is the same amount of water in
 all of these jars as in the standard.
- 6 code "1" if subject agrees that amounts are ^{the} same if you put
 together divided amounts.
- 7 Why? (1st reason)
- 8 Why? (2nd reason) code according to conservation categories
- 9 Why? (3rd reason) --see separate sheet.
- _____

Seriation

- 10 code "1" if child mentally coordinates the relations and produces
 correct series
- code "2" if child succeeds by "trial and error"
- code "3" if he produces disconnected pairs of elements
 or if he constructs another series on top of first
 or if he exchanges elements rather than adding them
 or if he inserts elements without regard to size

Card 2:
Column

description

- 11 code "1" if child correctly points out ^{to} smallest and biggest
code "0" if otherwise
- 12 code "1" if child correctly shows one which is next bigger; "0"
otherwise
- _____

MATRICES

col. 13-52

DATA FOR MATRICES 1-9; Data sheet is coded as follows for each matrix:

- 1) choice - code the number of the item the subject chooses as correct
- 2) criteria - each matrix will have the 2 or 3 correct "reasons" as a column headline, place a "1" in the column if child mentions the reason; "0" otherwise
- 3) stable - if subject is certain of his FINAL response code "1" in box marked "stable"; otherwise "0"

80

code number "2" [card #]

APPENDIX G

**Test and Task Procedures for Main Study:
Version used with Turkish Children**

BASE-LINE TESTS (Main Study)

Provoked Use of Qualitative Words:

- Malzeme : A:5 kırmızı marka
 B:4 yeşil marka
 C:5 aynı boyda mavi kalem
 D:3 aynı boyda kırmızı kalem
 E:10 değişik boyda eşit kalınlıkta çubuk
 F: 6 bilye
- Açıklama : Burada kümeler halinde bazı şeyler görüyorsunuz.
 Bir küme burada (A), başka bir küme burada (B),
 bir küme burada (C), bir küme burada (D), başka
 biri burada (E), bir tane de burada (F).
- Talimat : Şimdi bu kümeye bak (A). Bana bu kümeyle
aynı sayıda olan başka bir küme gösterebilir
 misin ?
- Talimat : Bana bu kümeden (A) daha çok olan bir küme
 göster.
- Talimat : Bana bu kümeden (A) daha az olan bir küme göster.

Provoked Use of Scalars and Vectors :

- Malzeme : 5 değişik kalem
 A: uzun ve ince kalem
 B: kısa ve ince kalem
 C: uzun ve kalın kalem
 D: kısa ve kalın kalem
 E: standart 6 köşeli 15 cm uzunlukta bir kalem
- Açıklama : Burada bu kalemleri görüyoruz.
- Soru : Bana bunlar hakkında birşey söyleyebilir misin ?
- Talimat : Bana uzun ve kalın olan bir kalem göster.
 : Bana bundan (E) daha uzun olan bir kalem göster.
 : Bana bundan (E) daha kısa ve daha ince olan
 bir kalem göster.

Spontaneous Use of Vectors and Scalars : (Differences)

- Malzeme : İki aynı renkte boyanmış tahta cisim
 a. (25 x .9 x .9 cm büyüklükte, 15 gr. ağırlıkta)
 b. (10 x 4.6 x 4.6 cm büyüklükte 160 gr. ağırlıkta)
- Açıklama : Burada iki tahta cisim görüyorsun.
- Soru : Bana aralarındaki farkı söyleyebilir misin ?
- Soru : Bana bu ikisinin arasında başka bir fark söyleyebilir misin ?
- Talimat : Birini bir eline, ötekini diğer eline al.
- Soru : Bana aralarındaki farkı söyleyebilir misin ?

Spontaneous Use of Qualitative Terms: (Relational)

(aynı, daha çok, daha az)

- Malzeme : 4 büyük bilye, 2 küçük bilye
 2 küçük plastik bebek, her birinin önünde aynı büyüklükte birer plastik tabak
- Talimat : Burada bu bilyeleri görüyorsun. Ben bunları iki kardeşe pay edeceğim.
- İşlem : 4 büyük bilye bir tabağa, diğer 2 küçük bilye öteki tabağa konur.
- Soru : Şimdi bu bilyeler kardeş payı oldu mu?
- Soru : Neden evet veya hayır ?
- Talimat : Hayır ise, sen paylaşdır bakayım.
- Soru : Şimdi tamam mı ?
- Soru : Neden ?

PIAGETIAN MAIN TASKS

Conservation of Continuous Quantity- (Liquid)Subtask A : Eşitlik

- Malzeme : a. 2 küçük silindir şeklinde cam kap(A_1 , A_2)
6 cm. uzunluğunda, 4 cm. genişliğinde
Bunlardan(A_1)renkli bir suyla yarıya kadar
doldurulur. Diğeri (A_2) boş bırakılır.
b. 15 cm. uzunluğunda 10 cm. genişliğinde renkli
suyla dolu şeffaf bir kap (X).
- Talimat : Ben buradaki sudan (X) bir miktar suyu bu kaba (A_2)
boşaltacağım. Bu kapla (A_2) bu kap(A_1) içinde
aynı miktarda su olduğu zaman bana durmamı söyle.
Bana bu iki kapta da aynı miktar su olduğu zaman
dur de.
- Soru : Aynı miktarda mı ?
- Soru : Neden ?

Subtask B : Yer değiştirme

- Malzeme : a. (A_1)
b. 13 cm. uzunluğunda, 2cm. genişliğinde silindir
şeklinde bir kap (B_1)
- İşlem : Ben (A_2) bu kabı şimdi bunun içine boşaltıyorum(B_1)
- Soru : Bu kapla (B_1) Bu kabın içindeki su miktarı aynı mı ?
- Soru : Neden evet veya hayır ?
- Soru : Birinde daha çok mu var?

Subtask C : Eşitlik Ayarlaması

- Malzeme : a. (A_1 , A_2)
b. A'larla aynı genişlikte fakat 8cm. uzunlukta
silindir şeklinde başka bir cam kap (B_2).
- Talimat : Ben bu kaptan (X) bu kaba (B_2) bir miktar su

koyacağım. Bana bu kapla bu kap içinde aynı miktar su olduğu zaman dur de.

Soru : Aynı miktarda mı ?

Soru : Neden evet veya hayır ?

Subtask D : Genelleştirme

Malzeme : a. (A_1) yarı dolu
b. 10 cm. uzunluğunda 7cm. genişliğinde silindir şeklinde bir cam kap

Talimat : Ben bu kaptan (X) bu kaba (B_3) bir miktar su boşaltacağım. Bu sefer bana bu kapla (A_1) bu kap (B_3) içinde aynı miktar su olduğu zaman durmamı söyle.
Bana ikisinde de aynı miktar su olduğu zaman dur de. Hazır mısın ?

Soru : Aynı miktarda mı ?

Soru : Neden ?

Soru : İçilecek su miktarı aynı mı ?

Subtask E : Bölüştürme

Malzeme : a. (A_1) yarı dolu, (A_2) boş
b. 2.5 cm. genişliğinde, 3.5 cm uzunluğunda 4 eşit silindir şeklinde cam kap (C_{1-4})

İşlem : Subtask A da olduğu gibi eşitleştirme

Talimat : Bana bu kapla (A_1), bu kap içinde (A_2) aynı miktarda su olduğu zaman dur de.

Soru : Aynı miktarda mı ?

Talimat : Burada bu kapları görüyoruz (C_{1-4})
Ben bu kabı (A_2) biraz buna (C_1), biraz buna (C_2), biraz buna (C_3), biraz da buna boşaltacağım.

Soru : Bunların hepsinin içindeki su miktarı (C_{1-4})

- Soru : bunun (A_1) içindekiyle aynı mı ?
- Soru : Neden evet veya hayır ?
- Soru : Bunların hepsini beraber tekrar bu kaba (A_2) boşaltırsam bu kapla (A_1) aynı olacak mı ?
- Not: Suyun hızzası her bir kapta (C_{1-4}) değişik olacaktır.

Conservation of Continuous Quantity - (Solid)

- Malzeme : 4 macun top- ünite ağırlığı 25 gr.
 Birbirlerine ağırlık orantıları 4-2-2-1
 {4}- karışık renklerde
 {2}- tek renkte
 {2}- karışık renklerde
 {1}- sade renkte
- Talimat : Bana içinde aynı miktar macun olan topları göster.
- Tahmin sorusu: Bunlardan birini sucuk şekline getirirsem, sucukta ve topta aynı miktarda macun olacak mı ?
- İşlem : Eşit toplardan biri 10 cm. uzunlugunda sucuk şekline getirilir.
- Soru : Bu sucukla bu topta aynı miktarda macun var mı ?
- Soru : Neden evet veya hayır ?
- Soru : Birinde daha çok mu var ?

Conservation of Discontinuous Quantity - (Number)

Task A : Bir kaptan diğetine boşaltma

Malzeme : Plastik kap içinde değişik renkte 23 bilye
2 eşit büyüklükte cam kap (A_1 , A_2)
1 uzun ve ince silindir cam kap (B_1)

Talimat : Burada bu bilyeler ve cam kaplar var. Ben
kendi kabıma (A_1) bir bilye koyduğum zaman sen
de kendi kabına (A_2) bir bilye koyacaksın.
Hazır mısın ?

İşlem : Birbiri ardına 20 bilye iki kaba dağıtılır.
Geriye 3 bilye kalır.

Talimat : Tamam, bu kadar yeter.

Soru : Bu kapla (A_1) bu kap (A_2) içindeki bilyelerin
sayısı aynı mı ?

Soru : Neden evet veya hayır ?

İşlem : Bak şimdi ben bu bilyeleri bu kaptan (A_2) bu
kaba boşaltıyorum (B_1).

Soru : Bu kapla (A_2) bu kap (B_1) içindeki bilyelerin
sayısı aynı mı ?

Soru : Neden evet veya hayır?

Soru : Birinde daha çok mu var ?

Task B : Kule ve Çarmih

Malzeme : 2 küme değişik renkte marka
a. 13 kırmızı marka (deneyin)
b. 15 yeşil marka (deneycinin)

Talimat : Şimdi bu markalarla iki kule yapacağız. Ben yere

bir marka koyduğum zaman sen de yere bir marka koyacaksın.

Şimdi ben yere bir marka koyuyorum, sen de yere bir marka koy bakayım.

İslem : Markalar birbiri ardına 2 kule şeklinde dizildiği vakit denekte 2 yeşil marka kalmış oluyor.

Talimat : Şimdi benimkiler bitti, onlar masada kalsın.

Soru : Senin kulendeki markalar benim kuledeki markalarla aynı sayıda mı ?

Soru : Kulenin birinde daha mı çok var ?

Talimat : Ben kulemi bu şekilde koyacağım.
(Çarmık şeklinde dizilir)

Soru : Benim şeklimle senin kulendeki marka sayısı aynı mı ?

Soru : Neden evet veya hayır ?

Soru : Birinde daha çok mu var ?

Conservation of Weight - (Solid)

Malzeme : 4 macun top- ünite ağırlığı 25 gr.
birbirlerine orantıları 4-2-2-1

- (4)- karışık renklerde
- (2)- tek renkte
- (2)- karışık renklerde
- (1)- tek renkte

Talimat : Bana aynı ağırlıkta olan 2 top gösterebilir misin ?
Eline alıp bak, aynı ağırlıkta olanları göster.

Tahmin sorusu: Bunlardan birini sucuk şekline getirsem,
bu toplu sucuk aynı ağırlıkta mı olacak ?

İşlem : Eşit toplardan biri 10 cm. uzunluğunda sucuk şekline getirilir.

Soru : Bu sucuk bu topla aynı ağırlıkta mı ?

Soru : Neden evet veya hayır ?

Soru : Biri daha mı ağır ?

Not: Bu testte tartı kullanılmamıştır, zira köy çocukları için tartıya bağlı ağırlık kavramı karışıklık yaratabilir.

Conservation of Distance

Malzeme : 2 tane 15 cm uzunluğunda ince tel

Soru : Burada bu iki teli görüyorsun.
Bunlar aynı uzunlukta mı ?

Talimat : Şimdi bu tellerden birini bu şekilde kıvrıyalım.

İşlem : Tellerden biri zig-zag şeklinde kıvrılır ve her iki telin bir ucu birbiriyle altalta gelecek şekilde masaya konur.

Talimat : Şimdi iki karıncanın bu teller üzerinden giderek her iki uçtaki evlerine varacaklarını farzedelim.

Soru : Bu karıncaların ikisi de bu yolu bitirip evlerine geldikleri vakit aynı mesafeyi mi kat etmiş olacaklar ?

Soru : Karıncalardan biri evine ulaşmak için daha çok veya daha uzun mu yürüyor ?

Soru : Neden evet veya hayır ?

Soru : Eğer bu karıncanın evine gitmesi 1 saat sürüyorsa (düz yolda) öteki karıncanın eve gitmesi ne kadar sürer (zig-zag yolda)?

Soru : İkisi de aynı zamanda mı evlerine varırlar ?

MATRICES (Multiple Classification)

Malzeme : 9 değişik tablo (Inhelder, Piaget, 1964 pp.159-69)

: Her bir tabloda boş kısma uyacak bütün seçimler deneye aynı anda gösterilir. Bunlardan biri deneyci tarafından boş kısma deneyin isteği üzerine yerleştirilir, ta ki denek kat'i karara varıncaya kadar.

Matrix 1 : (Alistirma itemi)

Talimat : Sana içinde resimler olan bazı kartlar göstereceğim. Bir tanesinde yuvarlaklar ve kareler var. Resimlerden bir tanesi eksik (boş kısma işaret edilir)
Bana bunlardan (seçenek resimlerine işaret edilir) hangisinin buraya (boş yere) uyacağını gösterir misin ? Şöyle ki boş yere resmi koyduğumuz vakit resimler böyle (yanlamasına) ve böyle (uzunlamasına) baktığımızda birbirlerine uysun. Şimdi en uygununu bul bakalım.

Soru :: Neden onu seçtin ?

Soru : Ondan daha iyi uyacak başka bir tane var mı ?

Soru : Neden ?

Çocuk doğru cevabı ve izahatı verdiği takdirde deneyci şöyle der: Evet, doğru. Bu sırada aynı şekil resimler var (yanlamasına sırayı işaret ederek) bu sırada da şekiller aynı büyüklükte (uzunlamasına sırayı işaret ederek). Eğer çocuk doğru seçimi yapmamışsa, veya doğru seçimi yapıp izahatını vermemişse, deneyci doğru kartı boş yere yerleştirip şöyle der: Diğer resimlerle en iyi uyan kart bu. Bu sıradaki resimlerin (yanlamasına) hepsi aynı

şekilde, bu sıradaki resimlerin (uzunlamasına) hepsi ise aynı büyüklüktedir.

Not : Bu izahât sadece lci Kart için verilir.

Matrix 2-9

Talimat : Şimdi bu karta bakalım. Bana bu resimler arasından (seçenek kartlarına işaret ederek) bu boş yere en iyi uyacak bir resim göster; şöyle ki bu karta bu şekilde (yanlamasına) ve bu şekilde (uzunlamasına) baktığımız vakit koyacağımız resim diğerlerine uysun.

Soru : Neden onu seçtin ?

Soru : Daha iyi uyacak başka bir resim var mı ?

SERİATION

Malzeme : 10 tane tahta çubuk, aynı renkte en kısası (9 x 9 x 0.9 cm.) uzunlukta ve diğer dokuzu ise birbirinden 1 cm. farklılıkta

İşlem : Çubuklar karmaşık halde masa üzerine bırakılır.

Talimat : Burada bu çubukları görüyorsun. Bana bunlardan en küçüğünü gösterir misin?

Talimat :: Ondan az biraz büyüğünü göster.

Talimat : Şimdi en büyüğünü göster.

Talimat : Ondan az biraz küçüğünü göster.

Talimat : Şimdi bu çubukları en küçüğünden başlayıp en büyüğüne doğru merdiven şeklinde sırala. Önce en küçüğünü, sonra biraz daha büyüğünü, biraz daha büyüğünü, vs. Bitirdiğin vakit çubuklar merdiven şeklinde olsun. Şimdi başla.

Soru : Bitti mi?

İşlem : Denek bir iki yanlışla sıralamayı bitirdiği vakit deneyci sorar:

Soru : Daha iyi yapabilir misin ?

Talimat : Ondan az biraz büyüğünü göster.

Talimat : Şimdi en büyüğünü göster.

Talimat : Ondan az biraz küçüğünü göster.

Talimat : Şimdi bu çubukları en küçüğünden başlayıp en büyüğüne doğru merdiven şeklinde sırala.
Önce en küçüğünü, sonra biraz daha büyüğünü, biraz daha büyüğünü, vs.. Bitirdiğin vakit çubuklar merdiven şeklinde olsun.
Şimdi başla.

Soru : Bitti mi ?

İşlem : Denek bir iki yanlışla sıralamayı bitirdiği vakit deneyci sorar:

Soru : Daha iyi yapabilir misin ?

APPENDIX H

**Test and Task Procedures for Main Study:
Version used with German Children**

GERMAN TRANSLATIONS OF THE BASE-LINE TESTS AND TASKS

1. Provozierter Gebrauch Qualitativer (relationaler) Begriffe:

(gleich, mehr, weniger)

(L) 5 rote chips

(M) 4 grüne chips

(N) 5 blaue Stifte gleicher Länge

(O) 3 rote Stifte gleicher Länge

(P) 10 Stäbe

(Q) 6 Murmeln

Instruktion: Hier sind mehrere Haufen. Hier ist ein Haufen(L), da einer

(M), noch einer da (N), einer hier(O), hier einer (P), einer hier (Q) und noch einer hier(R).

a. Schau Dir diesen Haufen an (5 rote). Ich möchte gern, daß Du mir einen Haufen zeigst, der die genauso viel hat wie dieser.

b. Zeige mir einen Haufen, der weniger hat als dieser

c. Zeige mir einen Haufen, der mehr hat als dieser(L).

2. Provozierter Gebrauch von Skalaren und Vektoren

5 Bleistifte

lang und dünn

kurz und dünn

lang und dick

kurz und dick

Standard sechseckig 9 cm lang

a. Zeige mir den Bleistift, der lang und dick ist

b. Zeige mir einen Bleistift, der länger und dünner ist als dieser
(klein und dick)

c. Zeige mir einen Bleistift, der länger und dicker als dieser

3. Spontaner Gebrauch von Vektoren und Skalaren (Unterschiede)

Instruktion : Hier sind zwei Stucke Holz

Frage : Kannst Du mir den Unterschied zwischen beiden sagen?

Frage : Kannst mir noch irgendwelche anderen Unterschiede zwischen ihnen nennen?

Instruktion : Nimm eines in die eine Hand, daß andere in die andere Hand

Frage : Kannst Du mir den Unterschied zwischen beiden sagen?

(zwei Stuck Holz gleicher Farbe a) 25 x 9 x 9 cm

b) 10 x 4.6 x 4.6

4. Spontaner Gebrauch qualitativer (relationaler) Termini (gleich, mehr, weniger)

Instruktion : Hier siehst Du einige Murmeln. Ich werde sie nun zwischen zwei Brudern (Schwestern) verteilen, 4 große Murmeln werden auf einen Teller, 2 kleine auf einen anderen Teller getan.

Frage : Ist daß fair? (gerecht)

Frage : Warum? (Warum nicht)

Frage : Warum Du das gerecht machen ?

Frage : Warum ist es jetzt gerecht ?

(4 große Murmeln, 2 kleine Murmeln,
2 Plastikteller gleicher Größe)

5. Invarianz kontinuierlicher Mengen : Flüssigkeit(2 Becher A_1 , A_2 , gleicher width, gleicher Höhe)Subtest A :

Instruktion : Ich werde jetzt von dieser Flüssigkeit (x)
in diesen Becher (A_2) gießen, Bitte sage halt, wenn
die gleiche Menge Flüssigkeit in diesem Becher (A_2)
ist wie in diesem (A_1). Sage mir, daß ich aufhören
soll, wenn beide die gleiche Menge (viel) haben.

Frage : Ist daß die gleiche Menge ?

Frage : Warum ?

Subtest B:

Instruktion : ich werde jetzt diesen Becher (A_2) in diesen Becher (B_1)
füllen.

Frage : Ist jetzt die gleiche Menge (viel) in diesen Becher (B_1)
wie in diesem Becher (A_1) ?

Frage : Warum (nicht) ?

Frage : Ist in einem Becher mehr ?

Subtest C :

Frage : Wenn ich diese Flüssigkeit (B_1) in diesen Becher
(A_2 , leer) gieße, bis wohin wird sie steigen

Subtest D:

Instruktion : Ich werde jetzt einige Flüssigkeit von diesem Becher
(X) in diesen Becher (B_2) gießen. Sage, mir, daß
ich aufhören soll, wenn die gleiche Menge wie hier drin
ist.

Frage : Ist da jetzt die gleiche Menge ?

Frage : Warum ?

Subtest E :

Instruktion : Ich werde jetzt Flüssigkeit von diesem Becher (X) in diesen
Becher (B_3) füllen. Sage mir bitte halt, wenn darin die
gleiche Menge ist wie in diesem Becher. Fertig ?

Frage : Ist da die gleiche Menge ?

Frage : Warum ?

Frage : Ist daß die gleiche Menge zum Trinken ?

Subtest F :

- Instruktion : Bitte sage mir, daß ich aufhören soll zu gießen, wenn die gleiche Menge in diesem Becher (X_2) ist wie in diesem (A_1).
- Frage : Ist daß die gleiche Menge ?
- Instruktion : Hier siehst Du diese Becher. Ich werde diesen Becher (A_2) in diesen Becher (C_1) gießen, in diesen (C_2) und in diesen (C_3), in diesen (C_4) (zu unterschiedlichen Teilen)
- Frage : Ist da die gleiche Menge in allen diesen Bechern ($C_{1,2,3,4}$) wie in diesem ?
- Frage : Wenn Due alle diese zurückgiest in diesen Becher (A_2), wird dann die gleiche Menge wie in diesem Becher (A_1) darin sein ?

6. Invarianz kontinuierlicher Mengen -fest

- Instruktion : Zweige mir die Kugeln, die gleich Menge Knete haben.
- Vorhersage
- Frage : Wenn ich diese in eine Wurst rolle, wird die dann die gleiche Menge haben wie diese Kugel (auf die andere zeigend) ?
- Tätigkeit : Die Kugel wird aus gerollt
- Frage : Hat die Wurst die gleiche Menge wie die Kugel ?
- Frage : Warum (nicht) ?
- Frage : Hat eines mehr ?

7. Invarianz diskontinuierlicher Mengen -Zahl

(3! Perlen und 2 Becher)

- Instruktion : Hier sind einige Kugeln und diese Becher.
Wenn ich eine in weinen Becher tue, tust Du eine in Beinen, fertig ?
- Tätigkeit : Eins-zu-eins-Verteilung von 3! Kugeln, drei bleiben auf dem Tablett
- Instruktion : Ich gieße jetzt meine Kugeln von diesem Becher (D_1) in diese (E) (dünn und hoch)

- Frage : Ist daß jetzt die gleich Menge (viel) Kugeln in diesem Becher (E) wie in diesem (D₂)?
- Frage : Warum (nicht) ?
- Frage : Hat einer mehr ?

8. Invarianz diskontinuierlicher Mengen (Zahl)

(14 grüne, 15 rote chips)

- Instruktion : Wir werden mit diesen Chips Türme bauen. Ich möchte, daß Du einen Chip nimmst, wenn ich einen nehme. Ich lege einen auf, Du legst einen auf.
- Tätigkeit : Wenn das eins-zu-eine-Bauen der Chips beendet ist, bleiben 2 auf dem Tisch liegen.
- Frage : Ist die gleiche Anzahl von Chips in meinem wie in Deinem Türme?
- Frage : Warum ?
- Frage : Hat ein Turm mehr ?
- Instruktion : Ich lege jetzt meine so hin (Kreutzform)
- Frage : Ist die gleiche Menge von Chips in Meinem Kreuz wie in Deinem Turm ?
- Frage : Warum (nicht) ?
- Frage : Hat eins mehr ?

9. Invarianz von Gewicht (fest)

- Instruktion : Zeige mir die Kugeln, die gleich Schwer (viel) wiegen.
- Vorhersage
- Frage : Wenn ich diese Kugel in eine Wurst rolle, wird sie das gleiche Gewicht haben wie diese Kugel ?
- Tätigkeit : Eine der identischen Kugeln wird zu 10 cm ausgerollt.
- Frage : Wiegt diese Wurst genau so viel die Kugel ? (or)
- Frage : Ist die Wurst genausi schwer wie die Kugel ?
- Frage : Warum ?
- Frage : Ist einen schwerer ?
- : Wiegt eine von beiden mehr ?

10 .Seriation :

10 h lzerne St be, gleicher Farbe, der k rzeste ist 9x 0.9 x 0.9 cm
Zuwachs 1 cm.

Die St be werden in Zufallsordnung gezeigt und flach auf den Tisch gelegt

Instruktion : Zeige mir den kleinsten und den zweitk rztentesten stab

: Zeige mir den langsten und den zweitl ngsten.

: Ich m chte gern, da  Du diese ordnest. Du f ngst mit dem k rzesten an und h rst mit dem lansten auf, so da  sie am Ende eine Treppe bilden (auf dem Tisch anzeigen)

Bist du fertig. Kannst du das noch besser machen (noch anders machen)

11. Invarianz diskontinuierlicher Quantit t (Zahl)

9 rote Chips werden gleichm  ig in zwei cm Abstand in gerader Linie aufgeteilt.

9 gr ne Chips werden mit dieser Reihe in Eins-zu-Eins-Entsprechung gelegt, von einem Haufen.

Frage : Ist da die gleiche viel in jeder Reihe ?

Frage : Warum?

T tigkeit : Wenn die Up zustimmt, da  die beiden Reihen die gleiche Menge haben, dann wird ein Chip von jeder Reihe am gleichen Ende weggenommen und in aller  ffentlichkeit zur Seite gelegt. Die gr ne Chips werden dann weiter auseinanderger cht, so da  diese Reihe l nger zu sein scheint als die rote.

Frage : Ist jetzt die gleiche viel von Chips in jeder Reihe?

Frage : Warum ?

Frage : Hat eine Reihe mehr?

T tigkeit : Die Reihe da  Vl (die verl ngerte) wird dann verk rtzt, so da  die Chips sich ber hren.

Frage : Hat diese Reihe die gleiche Menge von Chips wie diese?

Frage : Warum ?

Frage : Hat eine Reihe mehr ?

Frage : Welche?

12. Invarianz der Entfernung (räumlich und zeitlich)

2 Schnüre von 20 cm Länge.

Frage : Hier haben wir Schnüre
Sind sie gleich lang ?

Instruktion : Jetzt werde ich eine (A) biegen.
Die Schnüre werden so lingelegt, daß sie an einem
Ende übereinstimmen

Instruktion : Stell Dir einmal vor, da laufen jetzt 2 Ameisen diesen
Weg entlang, um ihren Hügel am Ende davon zu erreichen.

Frage : Wenn die beiden ankommen, haben sie dann die gleiche Strecke
zurückgelegt ?

Warum ?

Läuft eine mehr (länger) als die andere ?

Frage : Warum (nicht) ?

Frage : Wenn diese Ameise eine Stunde braucht, um nachhause zu
kommen, wie lange braucht diese ?

Frage : Kommen beide zur gleichen Zeit nachhause ?

(*) die auf der geraden Strecke

Matrizen

Matrix 1 (Probier-Item)

Instruktion : Ich werde Dir jetzt ein paar Karten mit Bildern darauf zeigen.
 Hier ist eine mit Kreisen und Vierecken darauf. Eins fehlt in diesem Bild (auf die leere Stelle zeigen).
 Ich möchte gern, daß Du mir zeigst, welches von diesen (auf die Auswahlbilder zeigen) hierher pass (auf die leere Stelle zeigen), damit das Bild richtig aussieht, wenn man es so (horizontal) hält und so (vertikal).

So, nun suche einmal das richtige aus !

Frage : Warum hast Du das ausgesucht ?

Frage : Gibt es ein anderes, das statt dessen passen würde?

Frage : Wie kannst Du sehen, daß es am besten zu den anderen paßt?

Wenn Vp nicht in der Lage war, die richtige Karte zu wählen, oder wenn sie die richtige gewählt, aber keinen korrekten Grund angeben konnte, dann legt der V1 die richtige Karte auf die Matrix.

" Dies ist diejenige, die am besten mit den anderen zusammenpaßt. Die Dinge in dieser Reihe (horizontal) haben die gleiche Form, und die Dinge in dieser Reihe (vertikal) haben die gleiche Größe."

Achtung : Diese Erklärung wird nur bei dem ersten Übungs-item gegeben?

Alle Wahlen für das fehlende Muster werden gleichzeitig gegeben und können in die leere Stelle gefüllt werden, wenn die Vp sie wählt, bis die Wahl stetig ist.

Wenn das Kind keine volle Antwort auf die erste Frage (warum) gibt, so versuche mit

- a. warum paßt dieses Bild am besten zu den anderen ?
- b. gibt es irgendein anderes, daß auch gut oder besser passen würde?

bis eine stetige Wahl erfolgt.

APPENDIX I

**Socio-Psychological Questionnaires Used In Main Study
Version used with Turkish Children**

Alman okullarında okuyan Türk çocukları için hazırlanmış
kısa bir anket :(1-3) sınıf ilkokul çocuklarına sorulacak!

- a. Okulu _____
- b. Öğrencinin sınıfı _____
- c. Haftalık ders saatleri _____
- d. Öğretmen sayısı _____

1. İsmi _____ Cinsiyeti Kız /Erkek

2. Doğum tarihi _____

3. Nerede Doğdun?

İli _____

Köyü _____

Bölgesi _____

4. Almanyaya gelmeden önce orada mı oturuyordun?

Evet _____ Hayır _____

Hayırsa neden?

..

5. Almanyaya ne zaman geldin? _____

6. Senden başka kaç kardesin var?

Kız _____ Erkek _____

7. Yasları kaç?

1-2-3-4-5-6-7-8-9-10-11-12-13-14-15-16-17-18-19-20

8. Baban Almayaya ne zaman geldi? _____

9. Annen Almanyaya ne zaman geldi? _____

10. Baban calisiyor mu?

Evet _____ Hayir _____

11. Ne is yapiyor? _____

12. Annen calisiyor mu?

Evet _____ Hayir _____

13. Ne is yapiyor? _____

14. Annen calisiyorsa kacta gidiyor evden _____

kacta geliyor _____

15. Türkiyede okula gittin mi hic?

Evet _____ Hayir _____

Gittinse nerede _____

kac sene _____

16. Almanyada kac sene okula gidiyorsun ? _____

17. Büyüyünce ne olmak istersin? _____

..

18. Evinizde mutfaktan baska kac oda var? _____

19. Sana köyde kim bakiyorda? _____

20. Bana köyünüzü anlat biraz!

Elektrik varmiydi, etc.

Alman İlkokullarında Okuyan Türk Çocukları İçin Hazırlanmış
Sınıf (4 - 6) Bir Anket

Anketçi için:

- a. Öğrencinin okulu _____
- b. Öğrencinin sınıfı
Türkçe hazırlık sınıfı _____
Türk çoğunluğu olan karma sınıf _____
Alman çoğunluğu olan karma sınıf _____
- c. Sınıftaki öğrenci adedi? _____
- d. Haftalık Almanca ders saatleri ne kadar? _____
- e. Sınıftaki Türk öğretici sayısı: _____
- f. Tüm haftalık ders saatleri ne kadar? _____

Anket:

1. İsmi nedir? _____ Kız/Erkek
2. Kaç yaşındasın? _____ (sene-ay)
3. Türkiyede nerede doğdun? İl _____
İlçesi _____
Köyü _____
4. Almanyaya gelmeden önce doğduğun yerde mi oturuyordun?
evet _____ hayır _____
Hayırsa, Almanyaya gelmeden önce nerede oturuyordunuz?

Ne kadar süreyle? _____
5. Neden orada oturuyordunuz?
(açık soru)
6. Almanyaya ne zaman geldin? _____ (sene-ay)
7. Evinizde senden başka kimler oturuyor?

- a. Baban
- b. Annen
- c. Erkek kardeşin
- d. Kız kardeşin
- e. baskaları _____ Kimler _____

8. Kaç kardeşin var ? (kendisi haric)

Kız _____ Erkek _____ (sayısı)

9. Sizden ayrı oturan kardeşlerin var mı?

Evet _____ Hayır _____

10. Kardeşlerin kaç yaşında?

(1- 2- 3- 4- 5- 6- 7- 8- 9- 10- 11- 12- 13- 14- 15- 16-
17- 18- 19- 20)

11. Almanyaya niçin geldiniz?
(açık soru)

12. Sen Almanyaya annenden sonra geldinse sana orada kim bakıyordu?

13. Baban Almanyaya ne zaman geldi? _____ (yılı)

14. Baban kaç yaşında? _____

15. Baban çalışıyor mu? Evet _____ Hayır _____

1. Ne iş yapıyor?

11. Ayda ne kadar kazanıyor? _____

16. Türkiyedeiken çalışıyor muydu? Evet _____ Hayır _____

1. Ne iş yapıyordu?

17. Baban Almanyada ne kadar kalmak istiyor? _____ sene!

18. Annen Almanyaya ne zaman geldi? _____

19. Annen çalışıyor mu? Evet _____ Hayır _____

20. Ne iş yapıyor?

21. Ayda ne kadar kazanıyor? _____

22. Annenin dışarda çalışması sence iyi bir şey mi kötü bir şey mi?

İyi _____ Kötü _____ Bilmiyorum _____

1. Neden?

23. Annen saat kaçtan kaçta kadar çalışıyor?

24. Annen Almanyada ne kadar kalmak istiyor? _____ (sene)

25. Kaç senedir okula gidiyorsun?

Türkiyede _____ Almanyada _____

26. Almanyayı nasıl konuşuyorsun?

İyi _____
Orta _____
Kötü _____

27. Okulda dersleri takibetmekte güçlük çekiyor musun?

Evet _____ Hayır _____ Biraz _____

1. Evetse sence neden?

28. Almanyada olmaktan memnun musun?

Evet _____ Hayır _____ Bilmiyorum _____ Hem iyi-hem kötü

1. Neden?

29. Türkiye'de kalmayı tercih eder miydin?

Evet _____ Hayır _____ Bilmiyorum _____

1. Neden?

30. Büyüyünce ne olmak istersin? _____

1. Neden ?

31. Bu meslekte çalışamazsan başka ne iş yapmak istersin ?

32. Babanın veya annenin mesleğinde çalışmak istiyor musun?

Evet _____ Hayır _____

1. Neden?

33. Annenle baban senin ne olmanı istiyorlar büyüyünce?

34. Okula gitmeseydin ne yapmak isterdin?

35. Türkiyedeki hayatını özleyiyor musun?

Evet _____ Hayır _____

36. Türkiyedeiken neler yapardın? Bana köyünüzü biraz anlatsana.

37. Bunlardan hangileri buradaki evinizde var?

a.mutfak _____
b.hela _____
c.banyo _____
d.buzdolabı _____
e.çamaşır makinesi _____
f.dikiş makinesi _____
g.televizyon _____
h.radyo _____
ı.ısıtma
 odun/kömür _____
 elektrik sobası _____
 kaldıröfer _____
j.bisiklet _____
k.telefon _____
l.otomobil _____

38. Evinizde kaç oda var? _____

39. Evinizin kirası ne kadar? _____

40. Türkiyede köyünüzde aşağıdakilerden hangisi vardı

- a. Elektrik_____
- b. Okul_____
- c. Cami_____
- d. Bakkal_____
- e. Kahve_____
- f. Carsi-pazar_____
- g. Araba yolu_____

41. Bir günde sabahdan akşama kadar neler yiyorsun?

sabah_____

öğlen_____

akşam_____

42. Ramazanda oruç tutuyor musun?

Evet_____Hayır_____Bazan_____

43. Kuran kursuna gidiyor musun?

Evet_____Hayır_____

(1) Hiç gittin mi?

44. Her çok çalışan çok para kazanır mı?

Evet_____Hayır_____Bilmiyorum_____

(1) Hayırsa neden?

45. Annen baban Türkiyede ev-arsa- dükkan aldılar mı?

Evet_____Hayır_____

Neler aldılar?

Nerede?

46. Sana birisi 1000 DM verecek olsa bu parayla ne yapardın?
47. Sokakta yürürken yerde içinde para dolu olan bir çanta bulsan ne yaparsın?
48. Almanyada en çok ne hoşuna gidiyor? _____
49. Almanyada hoşuna gitmeyen şeyler var mı? _____
50. Almanyada yaşamak ile Türkiyede yaşamak arasında ne gibi farklar var sence, bana söyler misin?
51. Okula seveerek gidiyor musun?
evet _____ hayır _____
Neden?
52. Sizin evde kaç kişi kalıyorsunuz? _____
53. Sen Almanyada ne kadar kalmak istiyorsun? _____
54. Burada Almanlarla Türklere eşit davranıyorlar mı?
Evet _____ Hayır _____ Bazan _____
Hayırsa neden?

• Şimdi seninle bir oyun oynayacağız. Elimdeki kartların üstünde çeşitli mesleklerin adı yazılı. Burada da beş basamaklı bir merdiven çizili. Sen de elindeki kartların hangi basamaklara ait olduğuna karar verip gereken yerlere koymaya çalış:

En üst basamakta herkesin en çok beğendiği meslekler.
bir alt basamakta herkesin iyi olarak bildiği meslekler,
ortada ne iyi ne de kötü olan meslekler.

Dördüncü basamakta (yukarıdan aşağıya doğru) o kadar iyi olmayan meslekler

En altta ise herkesin gözünde kötü olan meslekler bulunuyor.

İşte kartlar ve beş basamaklı merdiven, şimdi kartları yerlerine koymaya çalışalım.....

1) Babanın mesleği hangi basamağa aittir?

(2) Annenin mesleği hangi basamağa aittir?

(3) Senin ilerde sahibi olacağın mesleği nereye koyacaksın?

(4) Ailende yahut tanıdıkların arasında mesleğini birinci basamağa oturtacağın kimseler var mı?

Var _____ Yok _____

(5) Varsa bu kimseyi nereden tanıyorsun? Bu kimse hangi işte çalışıyor? _____

(6) Ailende yahut tanıdıkların arasında mesleğini ikinci basamağa oturtacağın kimseler var mı?

Var _____ Yok _____

(7) Okulu bitirince kesinlikte nerede kalmak istiyorsun?

Almanyada _____ Türkiyede _____ bilmiyorum _____

Almanyada kalacaksan hangi sebeplerden kalacaksın? _____

DOKTOR

PİLOT

BANKACI

ÖĞRETMEN

FABRİKATÖR (100 işçi çalıştıran)

POLİS

TREN KONTROL MEMURU

POSTACI

MAKİNA İŞÇİSİ

KAMYON ŞÖFÖRÜ

DÜKKADA SATICI

TEMİZLİK İŞÇİSİ

AYAKKABI BOYACISI

PROFESÖR

TEMİZLİKÇİ KADIN

BÜRO MEMURU

GARSON

AŞÇI

MEMUR

TEKNIKER

ELEKTRİKÇİ UŞTASI

ÇİFTÇİ

SUBAY

KURAN HOCA'SI

ŞARKICI

FİLİM ARTİSTİ

HAKİM

SENDİKACI

Scale for Evaluating the Occupations Listed

Best group	<u>1</u>
Second best	<u>2</u>
Neutral	<u>3</u>
Second worst	<u>4</u>
Worst group	<u>5</u>

APPENDIX J

**Socio-Psychological Questionnaires Used In Main Study
Version Used with German Children**

BEFRAGUNG DEUTSCHER GRUNDSCHULER IN WEST-BERLIN

Für den interviewer:

Name der Schule:

Art der Klasse in der Schuler ist: _____

gemischte Klasse mit Turkischer mehrheit: _____

Schulerzahl der Turkischer Kinder in der Klasse: _____

Gesamtzahl der Schulwochenstunden: _____

Name _____

1. Wie alt bist du? _____ Jahr/Monate

2. Wo bist du geboren? _____

3. Wieviel Geschwister hast du insgesamt?

Bruder _____

Schwestern _____

4. Wie alt sind deine Bruder? _____

Schwester _____

5. Wie alt ist deine Vater? _____

6. Als was arbeitet dein Vater? _____

7. Welchen Beruf hat dein Vater? _____

Bescriben

8. Wo arbeiter dein Vater? _____

Was dein Vater bei seiner Arbeit tut?

9. Arbeitet deine Mutter? Ja _____ Nein _____

10. Wenn ja, als was arbeitet sie? _____

11. Wo arbeitet sie? _____

W ist du was deine Mutter bei seiner Arbeit tut?

12. Wenn gehst sie zu Arbeit? _____

kommst sie zu Haus? _____

13. Wieviel Jahree warst du auf der Kindergarten? _____

14. Kennst du eine andere Sprache auser Deutsch? _____

Ja _____ Nein _____

Wenn ja, welche? _____

15. Habst du die andere Lander besucht?

Ja _____ Nein _____

Wenn ja, welsche? _____

16. Meinst du, das sich deine turkischen Mitschuler von deinen deutschen Mitschulern unterscheiden?

Ja _____ Nein _____

17. Wenn auf welche Weise, meinst du, unterscheiden siesich?

18. Kommst du mit ihnen aus?

Ja _____ Nein _____

Wenn nein, warum?

19. Was willst du einmal werden, wenn du erwashen bist?

20. Wurdetst du einen Beruf wie der deiner Vater oder Mutter wollen?

Ja _____ Nein _____

Warum?

21. Was sollst du auf Wunsch deiner Eltern nach der Schule werden?

22. Welche von den hier auf gefuhrten Sachen habt ihr zu Hause?

- a. Kuche
- b. Toilette
- c. Bad
- d. Kuhlschrank
- e. Waschmaschine
- f. Nahmaschine
- g. Fernsehen
- j. Radio
- i. Telefon
- 1. eigenes Auto

23. Wieviele zimmer habt ihr zu Hause? _____

24. Wieviele Personen leben bei euch zu Hause? _____

25. Was machst du am liebsten in deiner Freizeit?

26. Was machst du normalerweise sonntags?

27. Wenn dir jemand 1000 DM gabe was wurdest du damit anfangen?

28. Kannst du mir sagen, welche Dinge du als Erwachsener haben mochtest, die deine Eltern jetzt nicht haben?

29. Any comments from the interviewer is welcome!

Jetzt las uns mal ein Spiel spielen. Ich habe hier ein paar Berufe und ich mochter von Dir wissen, wo sie hingehoren. Hier ist mamlich eine Leiter mit funf Stufen.

Ganz oben sind die Berufe, die Leute am allerbesten finden.

Dann kommen die Berufe, von denen die Leute denken, das sie ganz gut sind. In der Mitte sind die Berufe, die nicht so gut und auch nicht so schlacht sind.

Auf der vierten Stufe sind dann Berufe, die schon nicht mehr ganz gut sind.

Uns ganz unten sind dann die Berufe, die in den Augen der meisten Leute ganz mies sind.

Hier sind die funf Stufen und hier sie Kartchen mit den Berufen:

Auf welche Stufe gehoren die Berufe?

1. Und auf welche Stufe gehort Dein Vater? _____
2. Und auf welche Stufe gehort Daine Mutter? _____
3. Wo wurdest Du Deinen zukunftigen Beruf einordnen? _____
4. Kennst Du jemanden in Deiner Familie oder von Deinen Bekannten, der eine Arbeit auf der 1. Stufe hat?

Ja _____ Nein _____

5. Der eine Arbeit auf der 2. Stufe hat?

Ja _____ Nein _____

6. Wenn Ja, Wer ist das? _____

Welche Arbeit hat er ? _____

Berufe:

ARTZ

FLUGZEUGPILOT

BANKBESITZER

LEHRER

FABRIKARBESITZER (mit 100 angestellten)

POLIZIST

ZUGSCHAFFNER

BRIEFTRAGER

ARBEITER IN DER FABRIK
(der eine Maschine betreut)

LAST AGENFAHRER

VERKAUFER IM LADEN

ARBEITER BEI DER MULLABFUHR

SCHUHPUZER

UNIVERSITATSPROFESSOR

PUTZFRAU

ANGESELITER IM BURO

KELLNER

KOCH

BEAMTER

TECHNIKER

HANDWERKER (e.g. Elektriker)

BAUER

OFFIZIER

SANGER/SCHAUSPIELER

Scale for Evaluating the Occupations Listed

Best group	<u>1</u>
Second best	<u>2</u>
Neutral	<u>3</u>
Second worst	<u>4</u>
Worst group	<u>5</u>

APPENDIX K

**Original Codebook for Main Study:
All Samples**

Card 2:
Column

description

CODE

Number

0-2

3

School/village

4-7

Age in months and years at the time of testing

8

Sex 1= Male, 2= Female

9-17

MATRICES

0= wrong choice

1= if correct choice with only one reason for
the two attribute matrices and two reasons for
three attribute matrices

and/or

2= unstable

2= if all necessary reasons for correct choice
is given and stable

Card 2:
Column

description

18

Seriation

0= if unable to seriate in the right order

1= if seriates by trial and error (perceptual
Gestalt form) or by combining 2, 3 groups.

2= if seriates only by less than 3 insertions
and/or inversions (systematic)

Conservation of liquid quantity

19

Transformation into tall and long container

0= if judgement incorrect

1= If judgement is "equal amount"

Explanation (categories 1-6)

Unstable

2= if judges "equal amount"

Explanation (1-6)

Stable (not more)

Card 2:
Column

description

20

Long and fat jar

0= If stops at level

Judges equal amount

stable (same to drink)

1= If stops at level

Judges equal amount

Explanation (same level)

Unstable (not the same to drink)

2= If stops below level

Judges equal amount

Explanation

stable (same to drink)

or

If stops at level

Judges unequal amount

Correct explanation

Stable (not the same to drink)

Card 2:
Column

description

21

Division and equalization

0= If not the same amount in 4 little jars as
in Standard A_1

and

Not the same when all poured back

1= If same amount in all 4 little jars as in
Standard A_1

but

more when all poured back

or not the same amount in each little jar
compared among themselves or individually
compared to Standard A_1

but

same amount when all poured back into A_2

2= If same amount in all 4 little jars as in
Standard A_1

and

same when poured back into Standard A_2

Conservation of Solid Quantity:

Card 2:
Column

description

22

Plasticine quantity

0= when judges unequal amount and stable (has
more)

1= when judges equal amount
Explanation (categories 1-6)
Unstable (has more)

2= when judges equal amount
explanation (1-6)
Stable (same)

23

Plasticine weight

0= if judges unequal and stable (weighs more
or less)

1= If judges equal weight
Explanation (1-6)
Unstable (more/less)

2= If judges equal weight
Explanation (1-6)
Stable (same)

Card 2:
Column

description

Conservation of discontinuous quantity

24

Beads

0= If judges unequal and stable (more)
or If judges equal amount
Explanation (1-3)
Unstable (more)

1= If judges equal amount after transferring
into long/thin jar
Explanation (1-3)
Unstable (more)

2= If judges equal at the second stage
(long/thin jar)
Explanation (1-9)
Stable (same)

Card 2:
Column

description

25

Towers-NUMBER

- 0= If judges equal or unequal number and says
one has more at the first stage

- 1= If judges equal at the second phase (cross)
Explanation (1-9)
Unstable (more)

- 2= If judges equal at the second phase (cross)
Explanation (1-9)
Stable (same)

26

Counters-rows in one to one correspondence

- 0= If judges unequal after subtracting one
from each row and says (now one has more)
when one row is contracted.

- 1= If judges equal when one is subtracted from
each row
Explanation (1-9)
Unstable (more when contracted)

- 2= If judges equal when one is subtracted from
each row
Explanation (1-9)
Stable (same when the row is contracted)

Card 2:
Column

description

- 27 The grade the child is attending
- 30 Conservation of distance and time
- 0= If judges longer distance and taking more
 time
- 1= If judges same distance but taking more
 time
- 2= If judges same distance and taking the same
 time

77 Card No.2

77-80 - Identification Number

CARD # 3

1-3 Identification number

Plasticene continuous Quantity

4	Code 1 if predicts equality
5	Code 1 if judges equality
6	Explanation I (1-7)
7	Explanation II (1-7)
8	Explanation III (1-7)
9	Code 1 if stable
	Code 0 if unstable

Plasticene continuous weight:

10	Code 1 if predicts equality
11	Code 1 if judges equality
12	Explanation I (1-7)
13	Explanation II (1-7)
14	Explanation III (1-7)
15	Code 1 if stable
	Code 0 if unstable

NUMBER-DISCONTINUOUS QUANTITY

Beads:

- 16 Code 1 if subject says they are the same amount
- 17 Code (1-3) for explanation
1. You put one and I put one
 2. I counted them (after the operation)
 3. They look the same amount - (perceptual)
- 18 Code 1 if same amount after the transformation (sub-task)
- 19 Code (1-9) for explanation
- 20 Code (1-9)
- 21 Code (1-9)
- Explanation categories:
- 1- You put one, I put one
 - 2- I counted them
 - 3- Height, level, perceptual
- Second phase
- 1- Compensation reversibility
 - 2- Inversion reversibility
 - 3- Addition + Subtraction
 - 4- Positive identity
 - 5- Previous equality
 - 6- Negative identity-statement of operations
- level, perceptual
- Code 0- if don't know/no answer
- 22 Code 1 if stable
- Code 0 if not stable

Towers: discontinuous-NUMBER

- 23 Code 1 if same number (ayni-sayi)
- 24 Code (1-3) for explanation as for beads
- 25 Code 1 if same number after the transformation (sub-task)
- 26 Code (1-9) for explanation
- 27 Code (1-9)
- 28 Code (1-9)
- 29 Code 1 if stable
- Code 0 if not stable

Counters- One to one correspondence: NUMBER

- 30 Initial equality
- Code 1 if correct
- Code 0 if not correct
- 31 Explanation (1-3)
- 1- They are in one to one correspondence
- 2- I counted them
- 3- They look the same- same length
- 32 Subtraction + expansion
- Code 1 if same number after the operation
- Code 0 if incorrect

33 Explanation (1-3) below

 1- You subtracted one from each row

 2- Statement of operations- you just put them apart

 from each other (negative identity)

 3- I counted them

34 Code 1 if stable

 Code 0 if unstable

Contraction (more?)

35 Code 1 if correct- same number

 Code 0 if incorrect

36 Code 1 if stable (more?)

 Code 0 if unstable

Distance and Time:

38 Code 1 if same distance

39 Code 1 if "not longer"

 Code 0 if "longer"

40 Explanation (1-7) conservation categories

41 Code 1 if arrive at the same time (1 hour)

 Code 2 if it takes less time on the crooked line

 Code 3 if it takes more TIME on the crooked line

42 Code 1 if they arrive in one hours' time

LIQUID

Initial equality:

43 Code 1 if subject says they are equal

44 Explanation

Code 1 if (same level)

Code 2 if (same size jars)

Code 3 if (same level and same size jars)

Transfer

45

Code 1 if subject agrees to equality

Explanation: 1 through 6

Categories from the highest to the lowest order

(1) compensation reversibility (reciprocity)

e.g. same in there; that is longer and thinner

(2) simple reversibility

e.g. (It would go back same, you can put it back in there)

(3) Positive identity

e.g. (It came out of that jar: It is the same liquid)

(4) Addition and subtraction

e.g. (There is none left in that jar...none taken...didn't spill any- that didn't have anything in it) Nothing was taken away or added to...

(5) Reference to previous equality

e.g. (these two were the same; poured same in that one Same because A+B had the same amount when we started

Card 3:
Column

description

46	Explanation I (1-7)
47	Explanation II (1-7)
48	Explanation III (1-7)
49	code 1 if judgement stable code 0 if "not stable"
	<u>Distractor-</u> (same diameter + taller)
50	code 1 if subject says equal
51	explanation (1-3) for initial equality
52	code 1 if judgement stable code 0 if "not stable"
	<u>Wider and taller container:</u>
53	Code 1 if stops below level Code 0 if stops at level
54	Code 1 if judgement correct Code 0 if incorrect
55	Explanation I (1-7)

Card 3
Column

description

56	Explanation II (1-7)
57	Explanation III (1-7)
58	Code 1 if consistent with judgement and explanation Code 0 if inconsistent
	<u>Sum and Division:</u>
59	Code 1 if equal amount in standard (1) as in standard (2)
60	Code 1 if same amount in all jars as in the standard one
61	Explanation I (1-7)
62	Explanation II (1-7)
63	Explanation III (1-7)
64	Code 1 if same amount when all divided amounts poured back into standard (2)

Card 3:
Column

description

Seriation:

65 Code 1 if shortest and longest is right

66 Code 1 if next shortest and next longest is right

67 Code (1-5) for the performance

5. Seriation by systematic selection not more
 than 2 insertions and/or 2 inversions

4. Seriation with more than 2 insertions
 and/or 2 inversions

3. Seriation with successive pairings with
 more than 2 insertions

2. 2 or more series/not able to finish

1. No seriation

77 Card Number 3

78-80 Identification Number

Card 3:
Column

description

68-69

Age of the oldest child

70

Father working in the village

1. Yes

2. No

71-72

Father's age

Card 3:
Column

description

73-74

Father's occupation

0 -

1. Sand-diver (seasonal worker)
2. Farmer - traditional peasant farmhand
3. Driver-(owns his own car)
4. Tailor - shoe maker
5. Carpenter - dogramaci - construction worker
6. Coppersmith
7. Grocer - butcher
8. Mechanic
9. Tornaci and blacksmith
10. Helper-waiter - sales boy
11. Beekeeper
12. Craftsman-gunmaker, knife-maker
13. Cook
14. Lumberjack - fireman
15. Own a shop-(coffee house, restaurant, store)
16. Fisherman - boatman - captain
17. Officer-soldier
18. Teacher
19. Doctor
20. Civil Servant - Bookkeeper - clerk

Card 3:
Column

description

75-76

Child's future aspiration

Code using the same list of occupations as above

CARD NUMBER 4

1-3 Identification Number

4 School/village

1. Deliktas - mountain village
2. Teknuz-dibek
3. Hayrioglu
4. Evrenye (Gemiciler)-coastal transtional village
5. Illiterate women-Efendikoy
6. Turks in German integrated school
7. Turks in Regeln school-(Resident more than 4 years)
8. Turks in Regeln school-(Resident less than 3 years)
9. German working class-integrated school

MATRICES

MATRIX I (4)

5 Choice (1-x)

6 Shape

Code 1 if mentioned

Code 0 if not

CARD NUMBER 4

7 Size

Code 1 if mentioned

Code 0 if not

8 Other reasons for the choice

Code 1 if mentioned

Code 0 if not or don't know or other

Partly

Looks like it

Sometimes

Association

Practical

Esthetic

Color

Shape

Size

9 Code 1 if stable

Code 0 if not

MATRIX II (6)

10 Choice (1-x)

CARD NUMBER 4

11 Reason-Shape

Code 1 if mentioned

Code 0 if not

12 Reason-Color

Code 1 if mentioned

Code 0 if not

13 Other reason

Code 1 if mentioned

Code 0 if not

(
14 Code 1 if choice is stable

Code 0 if not stable

CARD NUMBER 4

Matrix III (2)

15 Choice (1-x)

16 Reason-Shape

 Code 1 if mentioned

 Code 0 if not

17 Reason-Color

 Code 1 if mentioned

 Code 0 if not

18 Other reason

 Code 1 if mentioned

 Code 0 if not

19 Code 1 if choice is stable

 Code 0 if not stable

CARD NUMBER 4

MATRIX IV (1)

20 Choice (1-x)

21 Reason-Shape

 Code 1 if mentioned

 Code 0 if not

22 Reason-Duplication

 Code 1 if mentioned

 Code 0 if not

23 Other reason

 Code 1 if mentioned

 Code 0 if not

24 Code 1 if choice is stable

 Code 0 if not stable

CARD NUMBER 4

MATRIX V (1)

25 Choice (1-x)

26 Reason-Orientation

Code 1 if mentioned

Code 0 if not

27 Reason-Color

Code 1 if mentioned

Code 0 if not

28 Other reason

Code 1 if mentioned

Code 0 if not

29 Code 1 if choice is stable

Code 0 if not stable

CARD NUMBER 4

MATRIX VI (5)

30 Choice (1-x)

31 Reason-Color

 Code 1 if mentioned

 Code 0 if not

32 Reason-Shape

 Code 1 if mentioned

 Code 0 if not

33 Reason-Orientation

 Code 1 if mentioned

 Code 0 if not

34 Other reason

 Code 1 if mentioned

 Code 0 if not

35 Code 1 if choice is stable

 Code 0 if not stable

CARD NUMBER 4

MATRIX VII (7)

36 Choice (1-x)

37 Reason-Color

Code 1 if mentioned

Code 0 if not

38 Reason-Shape

Code 1 if mentioned

Code 0 if not

39 Reason-Orientation

Code 1 if mentioned

Code 0 if not

40 Other reason

Code 1 if mentioned

Code 0 if not

41 Code 1 if choice is stable

Code 0 if not stable

CARD NUMBER 4

MATRIX VIII (8)

42 Choice (1-x)

43 Reason-Color

Code 1 if mentioned

Code 0 if not

44 Reason-Shape

Code 1 if mentioned

Code 0 if not

45 Reason-Orientation

Code 1 if mentioned

Code 0 if not

46 Other reason

Code 1 if mentioned

Code 0 if not

47 Code 1 if choice is stable

Code 0 if not stable

CARD NUMBER 4

MATRIX IX (3)

48 Choice (1-x)

49 Reason-Color

Code 1 if mentioned

Code 0 if not

50 Reason-Shape

Code 1 if mentioned

Code 0 if not

51 Reason-Size

Code 1 if mentioned

Code 0 if not

52 Other reason

Code 1 if mentioned

Code 0 if not

53 Code 1 if choice is stable

Code 0 if not stable

BASE - LINE TESTS:

Spontaneous use of Vectors and Scalars

(two pieces of wood)

54 Use of vectors

0 = no vector

1 = daha form

2 = ondan uzun form and (azbir uzun)

3 = both

55 Use of superlative (en)

0 = none

1 = yes

56 Grammatical structure 1-A

57 mention weight

0 = no mention

1 = scalar

2 = vector

Pencils-Provoked use of Relational Terms

- 58 daha büyük (if subjects indicate the longer
0 = wrong pencil when asked to show a pen-
1 = right cil which is longer than this one.)
- 59 Bipartite (daha büyük ' daha kalın) vector

 (If subject indicates the right
0 = wrong pencil when asked to show a pen-
1 = right cil that is shorter and thicker
 than this one)

Provoked use of qualitative words

- [illegible]

CARD NUMBER 4

Marbles and dolls:

- 63 code 0 if no use of vectors
- code 1 if subject uses more or less (vector) (daha cok-fazla,
 daha az)
- code 2 if subject uses (Bu ondan cok)
- code 3 if subject uses both forms
- 64 code 1 if subject mentions number of marbles
- code 2 if subject mentions size of marbles
- code 3 if subject uses size and mentions number
- 65 Blank
- 66 code 1 if subject uses (subjective scalars) indicating quantity
- 0 = no subjective scalars
- 1 = most (en cok) superlative
- 2 = too many (cok fazla) comparative
- 3 = a lot (Bu cok)
- 4 = little (bu az)
- 5 = many - (bu cok & bu az)

CARD NUMBER 4

- 67 code 1 if ~~after~~ redistribution subject uses words
 (equal) or (same) to justify it.
 e.g. (ayni, bir, denk, tam)
- 68 code 1 if after redistribution subject uses number to justify the
 choice.
 2 if subject uses size
 3 if subject uses number and size of marbles
- 69 Result of redistribution
 0 = fail
 1 = equal number
 2 = equal number + same size
- 70 code 1 if subject mentions reason other than number and size
 to justify redistribution, e.g. color
- 71 Language use for the first distribution
 (1-A) bipartite
- 72 Number (buyuk-bas) animal
- 73 Number of house hold people

CARD NUMBER 4

74 Age of youngest child in the family

0 = subject youngest

1 = younger than 1 year

75 Number of children in the family

A = more than 9

76 Ordinal position of birth

77 Card Number 4

78-80 Identification

DETAILS

CONSERVATION EXPLANATION CATEGORIES:

(from the highest to the lowest on the hierarchy:)

1 - Compensation reversibility - (reciprocity)

(same in there and that is thinner and longer)

2 - Simple reversibility

(it would go back the same, you can put it back in there)

CARD NUMBER 4

- 3 - Positive identity
(it came out of that jar: it is the same liquid)
- 4 - Addition and Subtraction
(There is none left in that jar; none taken away, nothing added to,
Didn't spill any; that didn't have anything in it)
- 5 - Reference to previous quality
(these two were the same; you poured same in that one)
Same because $A+B$ had the same amount when we started
- 6 - Negative Identity
Statement of the operations-transformation
(you just poured it from that one; you poured it; you just rolled
it)
- 7 - Perceptual
(the lines are equal, they look the same, I can see it)
(this looks more)

PIAGETIAN TASKS:

- 1 - Conservation of continuous quantity - solid substance amount
 - a. picking up equal quantities of clay balls
 - b. Prediction of equality before rolling one out into a sausage
 - c. judging equal amount after the transformation

- 2 - Conservation of solid weight
 - a. Picking up equally heavy clay balls
 - b. Prediction of equal weight before rolling one ball into a sausage
 - c. judging equal weight after transformation

- 3 - Conservation of continuous quantity-amount: (liquid)
 - Sub-task A- Equalization of amount of water in jar A_1 to A_2
 - Sub-task B- Transference of amount of water in jar A_2 into jar B
 - Sub-task C- Equalization using distractor (same diameter/ higher)
 - Sub-task D- Generalization- equalizing amount in a fat and tall jar
 - Sub-task E- Division
 - Equality in the face of distribution of the equalized amount into 4 small jars

CARD NUMBER 4

4 -

Conservation of discontinuous quantity- NUMBER

1 - Beads

Sub-task A - one to one distribution of beads into two jars

Sub -task B - Pouring one pile into a measuring cylinder

2 - Towers

Sub-task A - One to one distribution of counters into towers

Sub-task B - Making one tower into a cross

3 - Rows

Sub-task A - Two rows laid out in one to one correspondence

Sub-task B - Equal subtraction of one counter from each row and contraction on one row

Sub-task C - Expansion of one row

5 -

Conservation of distance- length- and time:

(2 pieces of wire each 20 cms. long)

1 - Sub-task A - Will they have to walk the same distance?

Sub-task B - If one gets home in an hour how long will it take the other to get home?

6 -

MATRICES 1-9

CARD NUMBER 4

7 - Seriation
 9 sticks of 1 cm. increment

APPENDIX: (1-A)

1. Bipartite form of vector-full - 2 attribute

 This is taller and thinner - this is shorter and fatter

2. Bipartite vector-implied

 This is taller and thinner

3. Bipartite scalar-full

 This is tall and thin; this is short and fat

4. Bipartite scalar-implied:

 This is tall and thin

5. Bipartite Mixed full:

 This is taller and thin; that is shorter and fat.

6. Bipartite mixed implied:

 This is taller and thin

APPENDIX L

**Original Codebook for Main Study:
Migrant Turkish and German Samples**

CARD Number 1:

Column 1	Type of school
2	Conservation of Distance and Time
3	Name of the school
4-7	Age in months and years at the time to testing
8	Sex 1=Male 2=Female
9-17	MATRICES
18	Seriation
19	Conservation of Liquid (1)
20	Conservation of Liquid (2)
21	Conservation of Liquid (3)
22	Conservation of Solid Quantity (Plasticine)
23	Conservation of Weight (Plasticine)
24	Conservation of Discontinuous Quantity (Beads)

- 25 Conservation of Number (Towers with chips)
- 26 Conservation of Number (one to one correspondence with chips)
- 27 The Grade the child is attending (1-6)
- 28-29 Hours of school per week
- 30-31 Hours of German instruction
- 32 Proportion of Turkish to Deutsch children in the classroom
(first digit of the percent) 2=20 percent i.e. 4 kids in 20
- 33 Place of Birth by Region
1. Marmara
 2. Black Sea
 3. Eastern Anatolia
 4. Central Anatolia
 5. Western Anatolia
 6. South-Eastern Anatolia
 7. Mediterranean
- 34-35 Place of Birth by City
- see Appendix

- 36 Place of Birth in connection to
 city, town, or village
- 37 Which parent came first?
1. Father
 2. Mother
 3. Together
- 38 Length of separation from the mother
- 0 = came together (none)
 - 1 = less than 6 months
 - 2 = one year
 - 3 = two years
 4. = three years
 5. = more than 3 years
- 39 Number of years spent in Germany
- 1 = Less than one year
 - 2 = Less than Two years
 - 3 = Less than Three years
 - 4 = Less than Four years
 - 5 = more than 5 years

Appendix:Cities

Code for column 34-35

01 Adana	33 Icel (mersin)
02 Adiyaman	34 Istanbul
03 Afyon	35 Izmir
04 Agri	36 Kars
05 Amasya	37 Kastamonu
06 Ankara	38 Kayseri
07 Antalya	39 Kirklareli
08 Artvin	40 Kirsehir
09 Aydin	41 Izmit (kocaeli)
10 Balikesir	42 Konya
11 Bilecik	43 Kutahya
12 Bingol	44 Malatya
13 Bitlis	45 Manisa
14 Bolu	46 Maras
15 Burdur	47 Mardin
16 Bursa	48 Mugla
17 Canakkale	49 Mus

18 Cankiri	50 Nevsehir
19 Corum	51 Nigde
20 Denizli	52 Ordu
21 Diyarbakir	53 Rize
22 Edirne	54 Sakarya (adapazari)
23 Elazig	55 Samsun
24 Erzincan	56 Siirt
25 Erzurum	57 Sinop
26 Eskisehir	58 Sivas
27 Gaziantep	59 Tekirdag
28 Giresun	60 Tokat
29 Gumushane	61 Trabzon
30 Hakkari	62 Tunceli
31 Hatay (Anlakya)	63 Urfa
32 Isparta	64 Usak
90 Berlin	65 Van
	66 Yozgat
	67 Zonguldak

40

Father employed before departure

1= Yes

2= No

3= Don't know

41

If employed Father's occupation before departure

0= don't know

1= small business (restaurant, tea house, grocer, taxi
cab owner)

2= construction worker

3= farmer, fisherman, miner, -seasonal worker

4= craftman- tailor, carpenter, hairdresser,
electrician, mechanic, printer, fireman, technician

5= unemployed

6= factory worker

7= same as current job

8= manager, teacher, clerk -memur

9= waiter, salesman, driver, dustman

42

Father is employed presently

1= Yes

2= No

3= Collecting unemployment

43-44

Father's occupation in Germany

see appendix

45-46

Mother's occupation in Germany

00= Housewife

01= factory worker

02= cleaning woman

03= waitress, helper in the kitchen, hospital

04= seamstress, dressmaker

05= housecaretaker, concierge, kindergarten attendant

06= Cashier, office employee

07= nurse, cook

APPENDIX:

Father's occupation

Code for column 43-44

00	Unemployed
01	Factory worker
02	Construction worker
03	Mechanic
04	Painter-wall paper layer
05	Electrician
06	Carpenter
07	Waiter-helper-porter
08	Civil servant-teacher
09	Farmer
10	Salesman
11	Baker-cook
12	Small businessman-(restaurant, grocery store, tea house)
13	Tailor-hairdresser-dry cleaner
14	Truck driver
15	Cleaning man-dustman
16	Butcher
17	Teacher
18	Shoe shiner
19	Architect, engineer
20	Technician
21	Mason
22	Undertaker
23	Gardner

- 47-48 Father's income per month (code in hundreds of D.M.)
 e.g. 800=08
 1100=11
- 49-50 Mother's income per month
- 51-52 Father's age in years (approximate)
- 53 Number of years in school in Turkey (0-5)
- 54 Number of years in school in Germany (1-6)
- 55 Number of children in the family including the child in
 question
 1-9 A=10 or more
- 56 Number of household persons
 1-9 A=10 or more
- 57 One who works harder makes more money
 1=yes
 2=No
 3=don't know

58

What would he do if he didn't go to school - Alternatives

1= would learn an occupation on my own

2= would just work

3= return to home country

4= would do what is fun/lazy/leisure

5= no idea/ not possible to imagine

6= don't know

7= stay home and do housework, look after the siblings

59

Attending Quran Course

1= Yes

2= No

3= discontinued

60

Parents fast?

1= Yes

2= No

3= only one of them

61

What to do with 1000D.M.

- 1= give it to parents
- 2= spend some/save the rest
- 3= charitable use
- 4= buy things normally not possible (travel, books
etc).
- 5= buy clothing
- 6= buy daily needs/pay bills/food
- 7= save for future education, job training
- 8= go back home
- 9= put it in a bank

62

Child wants the same occupation as the parent

- 1= Yes
- 2= No
- 3= only if he can't be anything else

63-64

His future occupational choice

see appendix

65-66

His second choice for future occupation

see appendix

67-68

What the parents want him to be

- 1= whatever he wants
- 2= same as his own choice
- 3= don't know
- 4= parents indifferent
- 5= Marriage
- 6= make money
- 7= want him to be educated/have a profession
- 8=craftman

Choice of occupation

For column 63-64

- 00= don't know
- 01= Doctor
- 02= Engineer
- 03= Nurse
- 04= Policeman
- 05= Teacher
- 06= Tailor-seamstress
- 07= TV technician-electrician
- 08= hairdresser
- 09= Shop keeper (owner)
- 10= Carpenter
- 11= Auto mechanic-machinist
- 12= Scientist-chemist, zoologist
- 13= Secretary-office worker, stewardess

- 14= Pilot
- 15= School principal
- 16= Construction worker
- 17= Craftsman
- 18= Professor
- 19= Singer-actress
- 20= Sailor-driver-diver
- 21= Translator-journalist
- 22= Administrator-judge-lawyer-politician
- 23= Housewife
- 24= Religious leader (imam)
- 25= Civil servant
- 26= Farmer
- 27= Factory worker
- 28= Officer-military
- 29= Banker
- 30= Painter-artist
- 31= Sportsman
- 32= Unqualified helper-waiter etc.

69

Where he places his father's occupation

0= don't know

1-5

- 70 Where he places his mother's occupation
 0= don't know
 1-5
- 71 Where he places his future occupation
 1-5
- 72 Number of rooms besides the kitchen
 1-n
- 73-74 Amount of rent paid per month (1/10th of the amount)
 e.g. 90=09 130=13
- 75-76 The age of the oldest child in the family
- 77 CARD Number = 1
- 78-80 Identification Number

CARD Number 1 :

Code 1-5 for each occupation

- 1= Doctor
- 2= Pilor
- 3= Banker
- 4= Teacher
- 5= Factory owner

- 6= Policeman
- 7= Train conductor
- 8= Mailman
- 9= Factory worker
- 10= Truck driver
- 11= Shop assistant
- 12= Dustman
- 13= Shoe shiner
- 14= Professor
- 15= Cleaning Woman
- 16= Clerk
- 17= Waiter
- 18= Cook
- 19= Civil servant-memur
- 20= Technician
- 21= Electrician
- 22= Farmer
- 23= Officer
- 24= Quran teacher
- 25= Singer
- 26= Film star
- 27= Judge
- 28= Sendikaci-union man

78-80

ID Number starting from 300 on

77

Card Number I

APPENDIX M

Pictures from the villages in Anatolia - Northern Turkey.

1. The author with two pupils
in front of the village school.



2. A class picture taken at the
end of term.



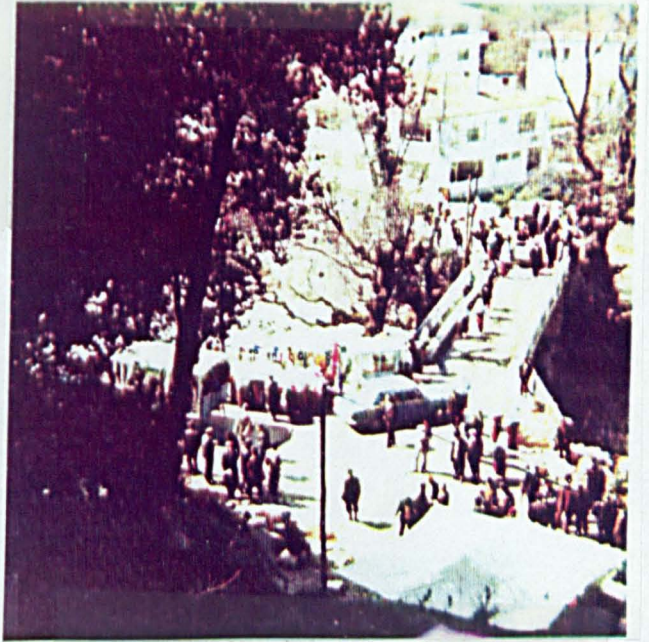
3. One of the mountain villages.



4. The grandmother and grandchild with whom the author stayed in one of the villages.



5. A view of the market place from the top in the coastal village.



6. Young women in their traditional regional dress taking a break on their way between two villages.

